THE

CANADIAN JOURNAL:

A REPERTORY OF

INDUSTRY, SCIENCE, AND ART;

AND A RECORD OF THE

PROCEEDINGS OF THE CANADIAN INSTITUTE.

EDITED BY

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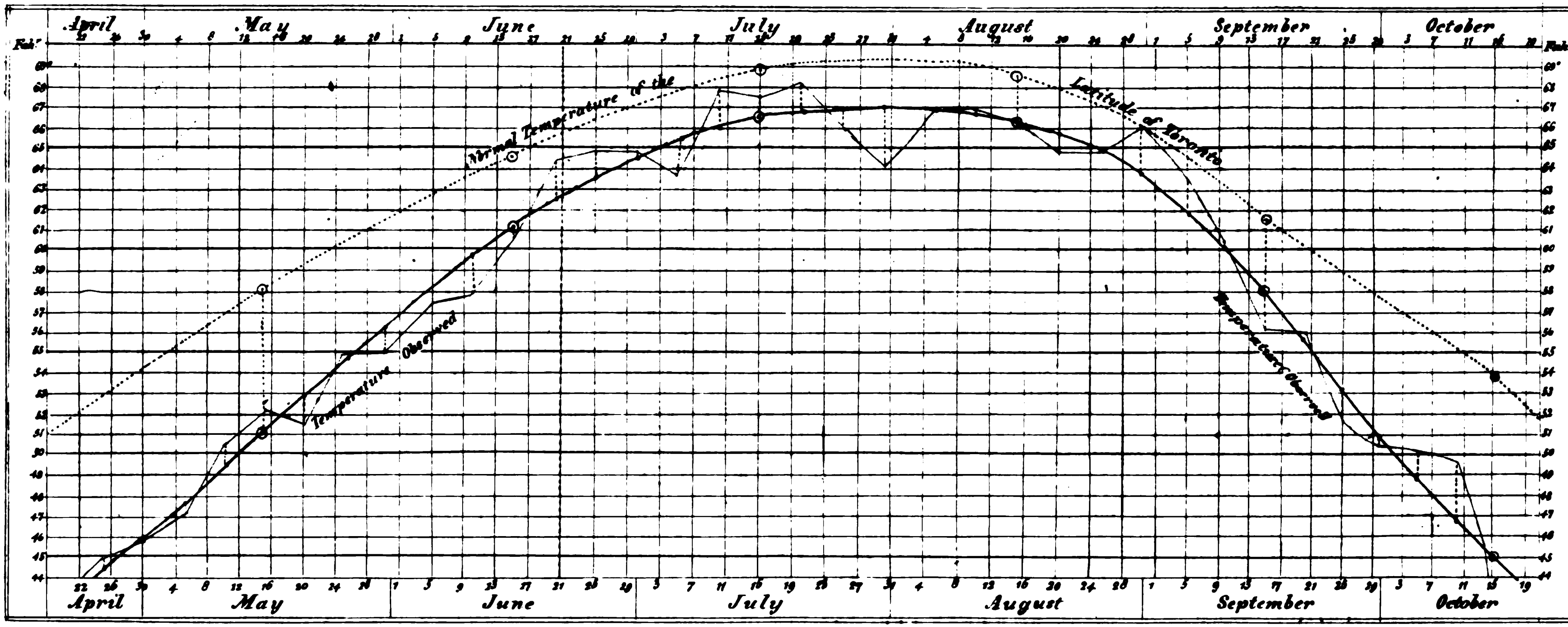

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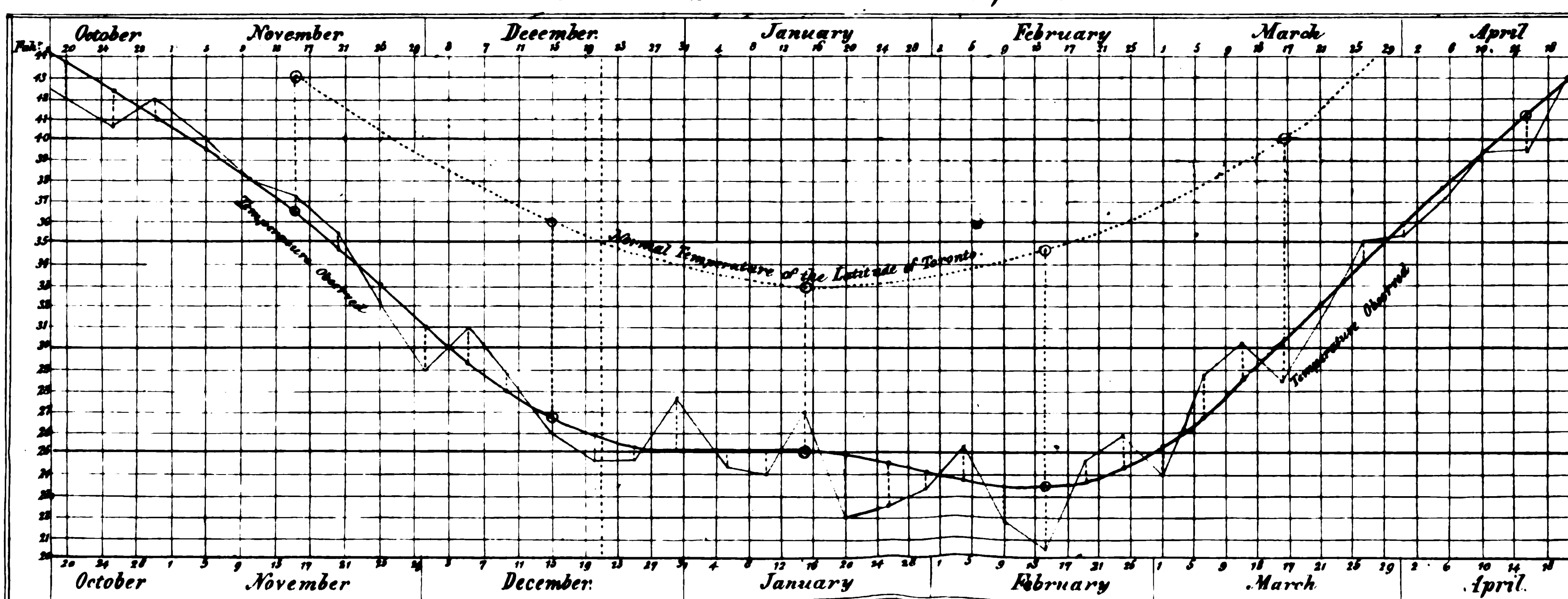

Hugh Scobie Lith.

The Canadian Journal.

TORONTO, AUGUST, 1853.

The commencement of another volume of the *Canadian Journal* offers a suitable opportunity for reviewing the progress which has been made during the past year, by the only scientific Society in Western Canada, which has hitherto been bold enough to publish a record of its transactions. So numerous and yet so fruitless had former efforts been to sustain in full activity a Society devoted to scientific and industrial pursuits, that when it was proposed—not much more than two years ago—to place the Canadian Institute upon a broad basis, and to publish its transactions, few, but those who laboured unremittingly for the accomplishment of that object, imagined more encouraging results than those which had been already attained by some of its predecessors. The experiment, for such it undoubtedly was, has been eminently successful, and the monthly records of the past Session of the Institute afford the strongest assurance that its general design was wisely conceived, and the efforts to sustain it spirited and generous.

Although much has been already accomplished, and the first impulse given to the representation of the interests of Science and the Industrial Arts in this Province, we are fully aware that the Society will not yet admit of any relaxation in the support and co-operation of its promoters. It will require the continuance of active exertion for several years in order to combine that intellectual strength which matured and well-directed associations almost invariably command. That the Canadian Institute will grow with the growth and strengthen with the strength of the country it represents, we do not for a moment question; but, in order to arrive rapidly at the age of entire self-reliance, when it will draw to itself that literary support which it has hitherto solicited, the undiminished exertions of its present members are still in request. On the score of pecuniary resources, there is happily neither difficulty or doubt. The Provincial Government, with a liberality which cannot fail to secure the gratitude of all who can appreciate its value, has extended its powerful arm to lift into active and vigorous life the youngest of Canadian Societies. It will be a source of lasting benefit to its present and future members, to be able to recognize some of the fruits of that timely aid in the form of well-filled library shelves and a growing museum of Industry and Art.

Embracing now nearly three hundred members, scattered over every part of the Province, the Institute is rapidly becoming the acknowledged centre of practical and theoretical Science, as well as of Literature, in Western Canada,—a country whose sudden increase in wealth and population, whose astounding progress in railway enterprise and commercial activity, are unmistakeable announcements of her social and political progress, and significant indications of her future destiny. May we not also see in the sudden spring of the Canadian Institute, from the weakness of infancy to the vigour of youth, an equally encouraging sign of advancing appreciations of the claims of Literature and Science. It would be unreasonable to suppose that there could already be found among the transactions of the Society, or in the contributions to this Journal, any positive additions to knowledge such as illumine the records of kindred associations in older countries. And yet a search would not be altogether in vain. Ethnologists will be thankful for the glimpse which is given of the condition and numbers af the race now passing away from the prairies and forests of the British Possessions in America. "The time may not be far remote when posterity may be counting its last remnants, and wishing that we in our day had been more alive to the facts, and more industrious in setting up marks by which we might measure the ebbing tide, and comprehend the destiny about to be consummated."* Meteorologists will acknowledge the worth of the elaborate monthly tables of temperature, magnetic disturbances, barometric fluctuations, rainfall, &c., which emanate from the Provincial Magnetical Observatory, and from the private Observatory of Dr. Smallwood, in Lower Canada. The hourly corrections of the Thermometer in Canada, derived from seven years of hourly observations at Toronto, will convey information to future observers of the most valuable description, which would, probably, have never seen the light but for the Canadian Institute.† Our readers will recognize with pleasure the local direction taken by many of the authors of the papers read before the Society at its weekly meetings. We venture to say that there is no surer way of awakening an interest in the study of Natural Science, than by selecting those departments for discussion which will permit of illustrations being brought from our forests, rivers, fields or rocks. Among the contributions to the Society's transactions, having a local or Canadian interest, we may mention:—"The Mineral Springs of Canada;" "The Provincial Currency;" "The Valley of the Nottawasaga;" "The Poisonous Plants in the neighbourhood of Toronto;" "The Rocks of Toronto," and "The Land Birds wintering near Toronto."

The subjects brought under the notice of the Institute during the last Session, will naturally attract the attention of those who interest themselves so far in its proceedings, as to endeavour to discover the tendencies of the Society from its transactions. Out of seventeen papers communicated during the Session of 1850-'1 and 1851-'2, no less than ten treated on topics relating to the Engineering and Surveying professions; whereas, out of fourteen papers read before the Society during the Session of 1852-'3, very few allusions were made by members to subjects bearing directly upon those professions. We give below a classification of the papers submitted to the Society during the last three years:—

1850, 1 and 2.

Engineering and Surveying	10
Geology and Physical Geography	6
Meteorology	1

* On the probable numbers of the native Indian population of British America, Capt. J. H. Lefroy, R. A., read before the Canadian Institute, May 1, 1852. See Can. Jour. Vol. 1, p. 193.

† See Can. Jour., vol. 1, p. 77.

1852-'3.

Engineering and Surveying	0
Geology and Physical Geography	3
Meteorology	1
Physical Science	1
Political Economy	2
Natural History	3
General Literature	3
Ethnography	1

It is very far from our intention to question the exertions of the professional gentlemen who first gave existence to the Canadian Institute, and from whose enlightened efforts in many directions it has hitherto drawn such a large measure of its influence and strength, but we would warmly urge the claims of the various Departments of Practical Science upon their numerous and accomplished representatives among the members of the Institute. Canada fills now so large a space in the world's eye, that the condition and progress of its means of internal communication,—its stupendous Railway system, its magnificent Canals,—its vast and navigable Rivers,—are become such prominent objects of interest abroad, as well as of vital importance to ourselves, that no reasonable means should be spared to afford the public authentic information respecting their construction, improvement and management. That a fair measure of support is given to the Institute through the pages of its Journal, we are glad to acknowledge, and we have every reason to believe that the extension of that support in the way of original contributions in all home matters relating to engineering and surveying operations, would be both interesting and advantageous to the public here and abroad. We have alluded thus pointedly to the absence of that general professional co-operation which was so liberally promised a year or so ago, in consequence of its having already attracted attention without the walls of the Institute, and led to the supposition that the Society, originally founded by the Engineers and Architects of the Province, is gradually being transformed into one of a purely Scientific character. Such, however, is very far from being the case. The Council, thoroughly impressed with the importance of sustaining in full vigour and efficiency, the practical character of the Society over which it presides, divided the sum set apart from the Government Grant of last year, for the purchase of books and Maps, into two equal portions, one half being placed at the disposal of the Committee representing the professions of the Engineer, the Architect, and the Surveyor, for the purchase of standard works on the subjects of those professions; the other half being disbursed by another Committee in procuring works of a more general description. We have every reason to believe that a similar distribution of the library funds will be made this year. The arrangements which have been already completed, or are yet in progress, will, most probably, secure to the present volume very comprehensive facilities for illustrating the magnificent public works of the Province, well known by their annually increasing revenue, but still without a place in the pages of any periodical or print.

Fourteen months ago, a document was issued by the Council of the Institute, soliciting promises of literary aid for the weekly meetings during the Sessions, and for the pages of the then contemplated Journal. The signatures of many gentlemen, admirably qualified to render the required assistance, were received. The Lecture room of the Institute as well as the pages of the first volume of its Transactions, bear witness to the industry with which that promise was fulfilled by many who contributed their much valued exertions to promote the objects of the Society. We are, however, still enabled to recognize on the list which now lies before us, the names of several gentlemen upon whom the burthen rests of recording their zeal for the progress of Science and Art, by works in addition to words.

It has been our misfortune to listen to the complaints of members of the Institute that the profession, manufacture or trade, in which *they* are engaged, has not attracted the attention of the Society or been fairly represented in the pages of the Journal. We have recently had the opportunity of perusing the report of the Proceedings of the Second Annual Conference between the Representatives of the Institutions in Union, and the Council of the Society of Arts. We find in the speech of the Chairman, at the opening of proceedings, a few trite observations, which apply with the same force to Individuals as to Institutions. In transcribing and commending these remarks to the attention of members who think themselves aggrieved, we venture to remind them of the peculiar position of the Canadian Institute, and of the claims which it has in its youth to the active and generous co-operation of *all* its members.

"The Council has felt that in the whole management of this Union, the principle enunciated at the last Conference must be borne in mind; namely, that it is the duty of each Institution to do its own work, and for the Society of Arts to do that amount of work which the Institutes cannot do of themselves, and which can only be done by means of combined action; and therefore I shall ask you to bear in mind that if there is any thing you think ought to be done which has not been done, you will reflect for an instant and consider whether it does not come under that class of duties which Institutes ought to have done for themselves, and which, in fact, no central authority whatever could do for them. Another point I will thank you to bear in mind is, that any thing in this world that is to be done, cannot be done in an instant. Works worthy of being done, do not grow up like mushrooms; if you wish to have an oak tree, you must begin by planting an acorn, and wait patiently for some time for it to develop itself. A number of impossible discussions have been proposed to the Council during the year: for instance, gentlemen living far North, have suggested that we should send down first-rate lecturers—men like Faraday—some 300 or 400 miles, and that the whole expense should come within a pound. Now I confess that no central power which I can conceive would be able to accomplish that feat; and it will be for you to judge how far such a thing is possible. Another point of difficulty I would mention has been the question of the Journal. The Council thought the establishment of a Journal, for every Institute to pour its suggestions into, and to record its advice, its feelings, and its wishes, would be very useful. They accordingly established a Journal at a very considerable drag upon their funds; in fact it involved the expenditure of the funds of the Society to an extent nearly equivalent to the subscriptions of all the Institutes. If that Journal is not what I think it ought to be, and if the Institutes have not corresponded with it, to tell their grievances and their wants, of course it cannot be said to be the fault of the Council."

The proceedings of the Institutions in Union with the Society of Arts at the Second Annual Conference, were distinguished by discussions on various subjects which tend to throw much light upon the numerous difficulties with which Literary and Scientific Institutions in England are fettered, many of which are happily unknown to the people of Western Canada. It will scarcely be accounted a digression if, in closing these remarks we extract the pith of the discussions, for the sake of information and encouragement.

The Chairman classed the subjects to be discussed under several heads. First, Parliamentary Papers; second, The Provision of Books and Maps; third, News-Rooms and Reading-Rooms; fourth, Lectures; fifth, Classes, &c.; sixth, Statistics and Trade Museums.

1st. Parliamentary Papers. No resolutions were adopted in relation to their distribution; the Report of the Committee not having been received. The opinion was unanimous that the greatest utility would result from a distribution of selected Parliamentary Papers among the Institutes. No difficulty, we apprehend, will for the future, be found to exist in this country if timely application be made in the proper quarter. We regret to say, however, that there is at present extreme difficulty experienced in obtaining some Parliamentary papers. They appear to have been distributed so indiscriminately immediately after their issue that at this period no complete copies are to be obtained of many important documents. The Canadian Institute has not yet succeeded in obtaining one perfect copy of the Provincial Geologist's Reports.

2nd. Books, Maps, Apparatus, &c.

The Rev. T. S. Howson. M. A., (Liverpool,) thought it might be of the greatest possible advantage to the whole country, if a permanent exhibition of educational apparatus could be established in London. He had learned more on the preceding evening by looking at the apparatus exhibited at the Mansion-house, than he could have done by reading a dozen catalogues.

Dr. Booth said, it was in contemplation by the Society of Arts to get up an Exhibition of Educational Apparatus not limited to the models produced in this country, but comprising those, many of them much superior, made on the continent, and especially in France and Germany. In fact what the Great Exhibition had done for manufactures they wished now to do for education; they would get the best models from different countries, and then gentlemen interested in the subject would be able to visit the Exhibition, and select such apparatus as they found best fitted for the purposes of instruction.

Mr. Pond (Southampton) said, in reference to the question of interfering with trade, the booksellers at Southampton had, unasked, made a reduction to the Polytechnic Institution there; and provided they were properly secured from private individuals getting books at the reduced rate, he felt sure that booksellers generally would readily agree to the arrangement.

Mr. Redgrave said that the Committee intended to take precautions that private persons should not be able to avail themselves of the advantage of the reduction, and booksellers would in point of fact be benefited by books getting noticed in quarters which they did not before reach.

The following Resolution was then moved, and carried unanimously:—

"That this meeting approve the steps already taken by the Institutes' Committee of the Society of Arts, respecting the cheapening of books, maps, diagrams, and apparatus; and request them to continue their labours."

With respect to books, maps and apparatus for educational purposes, the Canadian Institute has nothing to do, the duties of that department being most efficiently executed by the Education Office. In this particular, indeed, Canada is already far in advance of all probable results arising from the exertions of the Society of Arts. In 1851, the Chief Superintendent of Schools, in his Address to the Governor General upon the occasion of the opening of the new Normal and Model Schools, remarked that "the facilities for furnishing all our schools with the necessary books, maps and apparatus, will soon be in advance of those of any other country." The spirit of the resolution above quoted, is well worth the careful consideration of all literary and scientific bodies in Canada. It has already been carried into very successful and active operation by the Chief Superintendent of Schools for the formation of school libraries. Why should it not be adopted by self-sustaining schools 'of larger growth'?

3rd. News rooms and reading-rooms. Fiscal regulations retarding the spread of knowledge, scarcely exist in Canada. The following resolution has, therefore, no application in this country, except in relation to foreign books:—

"That this meeting is of opinion that the fiscal restrictions on paper, advertisements, news, and foreign books, have an injurious effect on the Institutions in Union with the Society of Arts, and that the Council be requested to proceed with their investigation on the subject, with a view to the abolition of all such restrictions."

One indignant speaker said that—

"It gave him a sense of shame at times when he saw the advertisements of professors of other countries announcing instruction at such low rates as 6d. per lesson, to think that for each of those announcements these gentlemen must pay 1s. 6d. to the English Government. He thought this was a question therefore on which the Chancellor of the Exchequer ought to know their opinion."

The following resolutions on the subject of lectures and class instruction, were carried unanimously:—

"That this Conference do express its confidence that the Society of Arts will make the best possible arrangements for facilitating the supply of Lecturers to the Institutions in Union; and does not deem it expedient to attempt to define the modes by which such arrangements should be made,"

"That the infusion of science and art into elementary instruction is required by the people generally, and is desirable for the ultimate success of Mechanics' Institutions, which could then advance science and art more efficiently by systematic class instruction."

"That it is desirable that the training-schools of this country should introduce into their courses of study a more thorough knowledge of the natural and physical sciences, and a system of instruction in art; and that the Council of the Society of Arts be requested to forward this Resolution to the President of the Council of Education, and to the various training Institutions."

The legal position of the Institutions in England is peculiar, and all discussion on that subject possesses, consequently, a local interest only. It is worthy of remark that one of the members stated that "he thought the experience of by far the greater number of Institutions, not only in London, but throughout the country, would show, that unless those who were now subject to taxation had some hope of immediate relief, the disruption and close of many of them would take place."

"The Chairman, in concluding the proceedings, said the Conference had been sitting five hours and a half; 106 speeches had been made, and each had occupied on an average three minutes and a half. He thought that was a statistic worth recording."

On the Physical Constitution of the Sun.

Abstract of a paper submitted to the French Academy, by M. Arago.

After briefly reviewing the phenomena of the solar spots and the peculiar radiance, less luminous than the rest of the orb, with which they are surrounded,—the penumbra,—M. Arago says:—This penumbra, first noticed by Gallileo, and carefully observed by his astronomical successors in all the changes which it undergoes has led to a supposition, concerning the physical constitution of the sun, which at first must appear altogether astonishing. According to this view the orb would be regarded as a dark body, surrounded at a certain distance by an atmosphere, which might be compared to that enveloping the earth, when composed of a continuous bed of opaque and reflecting clouds. To this first atmosphere would succeed a second, luminous in itself, and which has been called the *photosphere*. This photosphere, more or less removed from the interior cloudy atmosphere, would determine by its circumference the visible limits of the orb.—According to this hypothesis, spots upon the sun would appear as often as there were found in the concentric atmospheres corresponding vacant portions, which would permit us to see exposed the dark central body. Those who have studied with powerful instruments, professional astronomers, and competent judges, acknowledge that this hypothesis concerning the physical constitution of the sun, supplies a very satisfactory account of the facts. Nevertheless, it is not generally adopted; recent authoritative works describe the spots as scoriæ floating on the liquid surface of the orb, and issuing from solar volcanoes, of which terrestial volcanoes are but a feeble type.

It was desirable then to determine, by direct observation, the nature of the incandescent matter of the sun, but when we consider that a distance of 95,000,000 of miles separates us from this orb and that the only means of communication with its visible surface are luminous rays issuing therefrom, even to propose this problem seems an act of unjustifiable temerity. The recent progress in the science of optics, has however, furnished the means for completely solving the problem.

None are now ignorant that natural philosophers have succeeded in distinguishing two kinds of light, viz., natural and polarized. A ray of the former of these lights exhibits, on all points of its surface, the same properties; whilst, with regard to the polarized light, the properties exhibited on the different sides of its rays are different. These discrepancies, manifest themselves in a multitude of phenomena which need not here be noticed. Before going further, let us remark, that there is something wonderful in the experiments which have led natural philosphers legitimately to talk of the different sides of a ray of light. The word "wonderful" which I have just used, will certainly appear natural to those who are aware that millions and millions of these rays can simultaneously pass through the eye of a needle, without interfering one with the other. Polarized light has enabled astronomers to augment the means of investigation by the aid of some curious instruments, from which great benefit has accrued already—among others, the paralizing telescope, or polariscope, merits attention. In looking directly at the sun with one of these telescopes, two white images of the same intensity, and the same shade will be seen. Let us suppose the reflected image of this orb to be seen in water, or a glass mirror. In the act of reflection the rays become polarized, the lens no longer presenting two white and similar images; on the contrary they are tinged with brilliant colors, their shape having experienced no alteration. If the one be red, the other will be green; if the former be yellow, the latter will present a violet shade, and so on; the two colors being always what are called complementary, or susceptible by their mixture, of forming white. By whatever means this polarized light has been produced, the colors will displays themselves in the two images of the polarizing telescope, as when the rays have been reflected by water or glass. The polarizing telescope, thus furnishes a very simple means of distinguishing *natural* from polarized light.

It has been long believed, that light emanating from incandescent bodies, reaches the eye in the state of natural light, when it has not been partially reflected, or strongly refracted, in its passage. The exactitude of this proposition failed, however, in certain points. A member of the Academy has discovered that light emanating under a sufficiently small angle, from the surface of a solid or liquid incandescent body, even when unpolished, presents evident marks of polarization; so that in passing through the polarizing telescope it is decomposed into two colored pencils. The light emanating from an inflamed gaseous substance, such as is used in street illumination, on the contrary, is always in its natural state, whatever may have been its angle of emission. The means used to decide whether the substance which renders the sun visible is solid, liquid or gaseous, will be nothing more than a very simple application of the foregoing observations, in spite of the difficulties which appeared to arise from the immense distance of the orb.

The rays which indicate the margin of the disc, have evidently issued from the incandescent surface under a very small angle. The question here occurs,—The margin of the two images, which the polarizing telescope furnishes, do they, when viewed directly, appear colored?—then the light of these margins proceeds from a liquid body; for any supposition which would make the exterior of the sun a solid body is definitely removed by the observations of the rapid changing of the form of the spots. Have the margins maintained their natural whiteness in the glass? then they are necessarily gaseous. The incandescent bodies which have been studied by a polariscope, the light being emitted under angles, are the following:—of solids, forged iron and platinum; of liquids, fused iron and glass. From these experiments it may be said, you have a right to affirm, that the sun is neither fused iron nor glass; but what authority have you further to generalize? My response is this; following the two explanations that have been given of the abnormal polarization which presents rays emitted under acute angles, all ought to be the same, with the exception of the quantity, whatever be the liquid, provided that the surface of emergence has a sensible reflecting power. There would remain only the case, in which the incandescent body would, as to its density, be analogous to a gas; as for example, the liquid of an almost ideal rarity, which many geometricians have been led to place hypothetically, at the extreme limit of our atmosphere where the phenomena of polarization and colorization may perhaps disappear. I shall however, anticipate a difficulty which may suggest itself. It ought to be observed, that the lights proceeding from two liquid substances, may, according to the special nature of these substances, not be identical in reference to the number and position of the black bands of Frauenhofer, and which these prismatic hues offer to the eye of the philosopher. These discrepances are of a nature to be considerably augmented by the differently constituted atmospheres through which the rays have to travel before reaching the observer.

Observations made any day of the year, looking directly at the sun, with the aid of powerfully polarizing telescopes, exhibit no trace of colorization. The inflamed substances then, which defines the circumference of the sun, is gaseons. We can generalize this conclusion, since, through the agency of rotation, the different points of the surface of the sun come in succession to form the circumference. This experiment removes out of the domain of simple hypothesis the theory we have previously in-

dicated concerning the constitution of the solar photosphere. These results, let it be loudly proclaimed, are entirely due to the united efforts of the observers of the 17th and 18th centuries, and also in a certain measure to those of our contemporary astromomers. And, here, let me make a remark, which, when endeavouring to determine the physical constitution of the stars, we shall have occasion to apply. If the material of the solar photosphere were liquid, if the rays emitted from its margin were polarized, the two images furnished by the polarizing telescope would not only be colored, but they would be different in different parts of the circumference. Is the highest point of one of these images red, the point diametrically opposite will be red also. But the two extremities of the horizontal diameter will each exhibit a green tint and so on. If then, one succeeds in concentrating to a single point, the rays emitted from all parts of the sun's limb, even after their decomposition in the polarizing telescope, the mixture will be white.

The constitution of the sun, as I have just established it, may equally serve to explain how, on the surface of the orb, there exist some spots not black but luminous. These have been called faculæ, others of much smaller dimensions, and generally round have been called lucules. These latter cause the surface of the sun to appear spotted. It is a singular fact ; but I may trace the origin of the discovery of the faculæ and lucules to an administrative visit to a shop of novelties, on the Boulevards. "I have to complain," said the master of the establishment, "of the Gas Company; it ought to direct on my goods the broad side of the bat wing burner, whilst, by the carelessness of their servants, it is often the edge which is directed on them." "Are you certain," said one of the assistants, "that in that position the flame gives less light than in the other?" The idea, appearing ill-founded, and I would say, absurd, it was submitted to accurate experiment; it was determined that flame sheds upon any object as much light when it illuminates by its edge as when its broad surface was presented to it. Thence resulted the conclusion, that a gaseous incandescent surface of a determined extent is more luminous when seen obliquely than under a perpendicular incidence. Consequently, if like our atmosphere, when dappled with clouds, the solar surface presents undulations, the parts of these undulations which are presented perpendicularly to the observer, must appear comparatively dim, and the inclined portion must appear more brilliant; and hence every conic cavity must appear a lucule. It is no longer necessary in accounting for these appearances, to suppose that there exists on the sun millions of fires more incandescent than the rest of the disc, or millions of points distinguishing themselves from the neighboring regions by a greater accumulation of luminous matter.

After having proved that the sun is composed of a dark central body, of a cloudy-reflecting atmosphere, and of a photosphere we should naturally ask if there is nothing besides. If the photosphere terminate abruptly and without being surrounded by a gaseous atmosphere, less luminous in itself, or feebly refracting? Generally, this third atmosphere would disappear in the ocean of light, with which the sun always appears surrounded, and which proceeds from the reflection of its own rays upon the particles of which the terrestial atmosphere is composed. A means of removing this doubt presented itself; it was selecting the moment, when, during a total eclipse, the moon completely obscures the sun. Almost at the moment when the last rays emanating from the margin of the radiant orb, disappeared under the opaque screen formed by the moon, the atmosphere in the region, which is projected between the moon, the earth, and the neighbouring parts, ceased to be illuminated. In all our researches upon solar eclipses, innumerable unexpected appearances invariably present themselves; the observers were not a little surprised, when, after the disappearance of the last direct rays of the sun behind the the margin of the moon, and after the light reflected by the surrounding terrestrial atmosphere had also disappeared, to see rose-shaped prominences from two to three minutes in height, dart, as were, from the circumference of our satellite. Each astronomer, following the usual bent of his ideas, arrived at an independent opinion regarding the causes of these appearances. Some attributed them to the mountains of the moon; but this hypothesis would not bear a moment's examination. Others wished to discover in them certain effects of diffraction, or of refraction.—But the touch-stone of all theories is calculation; and uncertainty the most indefinite must follow, in reference to their application to the remarkable phenomena specified, those, namely, of which we have just been speaking. Explanations, giving neither an exact account of the height, the form, the color, nor the fixity of a phenomenon, ought to have no place in science. Let us come to the idea, much extolled for a short time, that the protuberances were solar mountains, whose summits extend beyond the photosphere covered by the moon at the moment of observation. Following the most moderate computations, the elevation above the solar disc of one of these summits, would have been 19,000 leagues. I am well aware that no argument because based on the vastness of this height, should lead to the rejection of the hypothesis, but it may be much shaken by remarking that these pretended mountains exhibit considerable portions beyond the perpendicular, which consequently in virtue of the solar attraction must have fallen down.

Let us now take a rapid glance of the hypothesis, according to which the protuberances would be assimilated to solar clouds floating in a gaseous atmosphere. Here we find no principle of natural philosophy to prevent our admitting the existence of cloudy masses from 70,000 to 90,000 miles in length, with their outlines serrated, and assuming the most distorted forms, only in further pursuing this hypothesis, one could not fail to be astonished that no solar cloud had ever been seen entirely separate from the circumference of the moon. It is towards this determination, the subject otherwise eluding us, that researches of astronomers should be directed. A mountain being incapable of sustaining itself without a base, the fortuitous observation of a prominence, separated in appearance from the margin of the moon, and consequently, from the real margin of the solar photosphere, should be sufficient utterly to overthrow the hypothesis of solar mountains. Such an observation has really been made. M. Kutochi who observed the eclipse of July 8th, 1850, writes: "the slender and redish striated appearance which was found near the northern prominence seemed to be completely detached from the margin of the moon." In the eclipse of the 28th of July, 1851, Messrs. Mauvais and Soujon, of Dantzic, and the celebrated foreign astronomers who had repaired to the different parts of Norway and the north of Germany, saw in all the selected stations without exception, a spot uniformly red, and separated from the limb of the moon. These observations put a definite termination to the explanations of the protuberances, founded on the supposition that there existed in the sun, mountains whose summits would reach considerably above the photosphere. When it shall be clearly demonstrated that these luminous phenomena cannot be the effect of the inflexions which the solar rays might experience in passing near the rough parts which fringe the circumference of the moon; when it shall be demonstrated that these rosy tints cannot be assimulated to simple optical appearances, and have, in truth, a real existence, that they are not real solar clouds, it will then be necessary to add a new atmosphere to the two of which we have spoken; for these clouds cannot be sustained *in vaccuo*. The existence of a third atmosphere is moreover established by phenomena of quite another nature, namely, by the comparative intensity of the

June, and indicated 28·727 inches; the *yearly mean* was 29·680 inches, the *yearly range* was equal to 1·602 inches. The atmospheric wave of November was marked by its usual fluctuations, the final trough terminated on the 30th day.

Thermometer.—The mean temperature of the air in January, was 12°·65, in February 21°·90, in March 20°·7, in April 38°·38, in May 52°·27, in June 66°12, in July 72°33, in August 68°.02, in September 59°·15, in October 45°·69, in November 33°·0, in December 24°·64 F.

The highest reading of the maximum thermometer was in July, and marked 100°·5; the lowest reading of the minimum thermometer was in January, and was –28°·0. The mean temperature of the quarterly periods was, winter 16°45, spring 37°·11, summer, 68°·82, autumn 45°.94. The *yearly mean* was 42°·86, and the *yearly range* 128°·5. The greatest intensity of the Sun's rays was in July, and indicated 122°5, the least intensity was in November, and was 62°4.

The *mean humidity* of the atmosphere in winter was ·781, in spring ·806, in summer ·810, and in autumn ·895. The *yearly mean* of humidity was ·823.

Rain fell on 88 days, amounting to 47·131 inches and was accompanied by thunder and lightning on 17 days. *Snow* fell on 48 days amounting to 84·61 inches *on the surface.* The equivalent of 1 to 10 as used by the Smithsonian Institute at Washington, for the comparison of melted snow to rain does not hold good in this climate; it varies from 1 to 5 to 1 to 8. I have undertaken a series of experiments on this point, which I have not at present brought to a close.

The whole amount of snow which fell in the winter 1851–2, amounted to 95·920 inches; the first snow fell on the 25th of October, 1851, and the last on the 16th of April, 1852.

The amount of evaporation was regularly measured and recorded during that period of the year, when the thermometer stood above the freezing point, and owing to frosty nights, and frost also during some days, no accurate measure could be taken. The amount of evaporation in May was 3·720 inches, in June 3·450, in July 4·150, in August 2·620, in September 2·020, and in October 1·220: this period includes what I consider could be taken with anything approaching to accuracy.

The most prevalent wind during the year was the west, the next in frequency was the E. N. E., the least prevalent wind was the N. by W. The mean of the maximum velocity (as measured by an anemometer similar in construction to Dr. Robinson's) was 17·632 miles per hour; the mean minimum velocity was equal to 0·463 miles per hour.

The Aurora Borealis was visible on thirty-six nights, at the following hours, and its appearance was generally followed by rain in summer and snow in winter.

January 19*th*, 10 P.M. Faint auroral arch—sky clear; 26*th*, 10 P. M. Do., dark clouds in the horizon.

February 15*th*, 4 A.M. Bright aurora in the north, streamers shooting to the zenith; sky clear. 19*th*, at 6·30 P. M., the heavens presented a curtain or canopy of auroral light; streamers of yellow, green and crimson were sent up in rapid succession from the horizon to the zenith, where they formed a cupola or corona near *a Aurigæ;* at the horizon, the arch extended from E. to N. W. Stars of the 4th and 5th magnitude were visible through these magnificent curtains of auroral light. These appearances lasted about 30 minutes, and then gradually faded away, as if to seek a rest, and to shine forth with still greater splendour; for at 10 P. M., the northern horizon presented a low auroral arch of a yellow colour, while in the southern horizon, stretching from E. to W., a most splendid display of streamers rose to an apex, about 60° above the horizon; the streamers were of the same colour as in the former part of the evening; these appearances lasted 20 minutes; the northern arch remained still visible. Volta's No. 1 electrometer marked 0·76 positive electricity; there was no change indicated during or after the phenomenon. 20*th*, 10 P. M. Low auroral arch in the north very faint; sky clear.

March 7*th*, 7 P. M. Faint aurora, occasional streamers; sky clear. 19*th*, 10 P. M. Low auroral arch, bright; sky clear. 20*th*, 9 P. M. Faint auroral arch; sky clear.

April. No aurora observed this month.

May 5*th*, 10 P. M. Faint auroral patches; sky clear. 6*th*, 10 P. M. Faint auroral arch; sky clear. 18*th*, 10 P. M. Faint auroral arch; horizon clouded.

June 11*th* 8·43 P. M., the heavens presented an auroral arch 3° broad, of great magnificence; the arch commenced in the E. at the horizon, stretching to the zenith, and descending nearly due west to the horizon; the colour was crimson, at other times pale green; the borders or edges were well defined. Stars of the 4th and 5th magnitudes were distinctly visible through it; a few *light cirri* were discernible in the eastern horizon, but otherwise the sky was clear; a faint auroral light was visible in the north. The arch vanished at 9·20 P. M. The electrometer marked 0; wind west, velocity 1·10 miles per hour. 15*th*. Low auroral arch from E. to W.N.W., bright yellow colour; occasional streamers to the zenith, from 9.40 to 11·10 P.M. 23*rd*, 11·40 P.M.. faint auroral light; sky clear.

July 5*th*, 10 P.M. Auroral bow stretching from E to W.N,W., 2° wide and bright; sky clear. Wind south, velocity 0·12 miles. 6*th*, 10 P. M. Auroral light in the north, moderate brightness; streamers; sky clear. 7*th*, 10 P. M. Patches of auroral light, or clouds from E. N. E. to W. S. W., which vanished, leaving a broad auroral arch; sky clear. 10*th*, 10 P. M. Auroral streamers, bright. *Cumul. Strat.* 4. 20*th*, 9 P. M. An arch of light auroral clouds, 1° in width, passing through the constellations Cygnus, Lyra and Hercules to the horizon, lasted 20 minutes, sky clear, wind S.W., velocity 6·26 miles. 29*th*, 8 P.M. Auroral arch bright. *Cumul. Strat.* 4. Heat lightning very vivid.

August 5*th*, 10 P. M. Very faint auroral light. *Cirr. Cumul.* 4. 6*th*, 10 P.M., do. *Cumul. Strat.* 4. 10*th*, P. M. Bright auroral arch broad; dark segment underneath; sky clear. 11th, 10 P. M. Faint auroral clouds in the north; sky clear.

September 3*rd*, 10 P. M. Faint auroral light; sky clear. 4*th*, 10 P. M. Bright auroral arch, extended and sending up occasional streamers; sky clear. 17*th*, 10 P. M. Faint auroral arch, low, sky clear; 18*th*, 10 P. M., do. 29*th*, 10 P. M. Floating auroral clouds, varying in brightness; sky clear.

October 6*th*, 10 P. M. Masses of auroral clouds in the north of moderate brightness. *Cirr. Cumul.* 4. 19*th*, 10 P. M. Auroral arch faint and low. *Stratus* 2. 20*th*, 9 P. M. Faint auroral arch, with dark segment underneath, at 9·20, a fine display of streamers; sky clear.

November 11*th*, 10 P. M. Bright auroral streamers, not very extended; sky clear.

December 1*st*, 3 A. M. Auroral light in the north, bright and extended; sky clear. 29*th*, 10 P. M. Low auroral arch; sky clear.

Lunar halos visible on six nights. A *lunar rainbow* was also visible on the 29th February. *Fogs* were observed on six mornings. *Shooting stars* were seen on the 18th of July, and 9th and 10th of August. A slight shock of an *earthquake* was felt

on the 11th of February at 5·40 A. M., barometer 29·067, thermometer 38·5, wind E. by N., velocity 6·00 miles per hour; the *wave* came from the W. N. W. The barometer continued to fall until 11 A. M., it was then 28.892 accompanied by slight rain (0·50 inch;) the wind veered about noon by the N. to the W. S. W., and increased to a velocity maximum 30·57 miles per hour, which continued during the day following; wind W. N. W.

Electrical state of the atmosphere.—The atmosphere has afforded indications of electricity, varying in intensity on every day or nearly so, during the year, and was *generally* of a *positive* or *vitreous* character. Two remarkable *electrical storms* occurred on the 23rd and 31st of December, indicating an intensity of 450° in terms of Volta's electrometer, No. 1: sparks of of $\frac{5}{10}$th of an inch were constantly passing from the *conductor* to the *discharger* for several hours each day: it was of a *positive* character, with frequent and quick changes to negative electricity. An increase of intensity is always observed during the snow storms of our winter; this increase generally possesses the character of positive electricity, although frequent signs of negative electricity have been observed here; this change from positive to negative electricity appears to be connected with change in the form of crystals of snow. The crystals of snow in this climate during the very severe weather, are generally those described by Scoresby, and figured from 16 to 20 in Kæmtz's Meteorology, also fig. 3; and plain hexagonal prisms have likewise been observed.

St. Martin, Feb. 1, 1853.

The Mississippi and Ohio Rivers.

From the Report by Charles Ellet, Jr., C. E.

THE MISSISSIPPI.—To be able to form a just conception of the present physical constitution of the delta, and the causes of its overflow, we must imagine a great plane sloping uniformly from the mouth of the Ohio, in a direction deviating but little from a due southerly course, to the Gulf of Mexico. The length of this plane, from the mouth of this river to the waters of the gulf, is 500 miles. Its northern extremity is elevated 275 feet above the surface of the sea, and is there and every where nearly level with low water in the Mississippi River. Its total decent, following the highest surface of the soil, is about 320 feet, or at the rate of 8 inches per mile.

The breadth of this plane, near the mouth of the Ohio, in an east and west direction, is from thirty to forty miles; and at the Gulf of Mexico it spreads out to the width of about one hundred and fifty miles.

It is inclosed on the east and west by a line of bluffs of irregular height and extremely irregular direction.

This plane, containing about 40,000 square miles, has been formed in the course of ages from the material brought down from the uplands by the Mississippi and its tributaries. The river has therefore raised from the sea the soil which constitutes its own bed. It flows down this plane of its own creation, in a serpentine course, frequently crowding on the hills to the left, and once passing to the opposite side and washing the base of the bluff which makes its appearance on the west at the town of Helena.

The actual distance from the mouth of the Ohio to the coast of the gulf is, in round numbers, as stated, 500 miles. The computed length of the Mississippi River, from its confluence with the Ohio to the mouth of the South-west Pass, is 1,178 miles; and the average descent at high water $\frac{27}{100}$ths of a foot, $3\frac{1}{4}$ inches per mile.

The course of the river is therefore lengthened out nearly seven hundred miles, or is more than doubled by the remarkable flexures of its channel; and the rate of its descent is reduced by these flexures to less than one-half the inclination of the plane down which it flows.

In the summer and autumn, when the river is low and water is scantily supplied by its tributaries, the surface of the Mississippi is depressed at the head of the delta about forty feet, and as we approach New Orleans, twenty feet below the top of its banks, It then flows along sluggishly, in a trench about 3,000 feet wide, 75 feet deep at the head, and 120 feet at the foot, and inclosed by alluvial and often caving banks, which rise, as stated, from 20 to 40 feet above the water.

But when the autumnal rains set in, the river usually rises until the month of May, when it fills up its channel, overflows its banks, and spreads many miles over the low lands to the right and left of its trace. This leads to another important feature in the characteristics of this great stream.

The Mississippi bears along at all times, but especially in the periods of flood, a vast amount of earthy matter suspended in its waters, which the current is able to carry forward so long as the river is confined to its channel. But when the water overflows the banks, its velocity is checked, and it immediately deposits the heaviest particles which it transports, and leaves them upon its borders; and as the water continues to spread further from the banks, it continues to let down more and more of this suspended material—the heaviest particles being deposited on the banks, and the finest clay conveyed to the positions most remote from the banks. The consequence is, that the borders of the river, which received the first and heaviest deposits, are raised higher above the general level of the plane than the soil which is more remote; and that, while the plane of the delta dips towards the sea at the rate of eight inches per mile, the soil adjacent to the banks slopes off at right angles to the course of the river, into the interior, for five or six miles, at the rate of three or four feet per mile.

THE OHIO.—This noble tributary rises on the borders of Lake Erie, at an average elevation of 1,300 feet above the surface of the sea, and nearly 700 feet above the level of the lake. The plane along which this river flows is connected with no mountain range at its northern extremity, but continues its rise with great uniformity, from the mouth of the Ohio to the brim of the basin which incloses Lake Erie. The sources of the tributary streams are generally diminutive ponds, distributed along the edge of the basin of Lake Erie, but far above its surface, and so slightly separated from it, that they may all be drained with little labour down the steep slopes into that inland sea.

From these remote sources, a boat may start with sufficient water, within seven miles of Lake Erie, in sight, sometimes, of the sails which whiten the approach of the harbor of Buffalo, and float securely down the Connewango, or Cassadaga, to the Alleghany, down the Alleghany to the Ohio, and thence uninterruptedly to the Gulf of Mexico. In all this distance of 2,400 miles, the descent is so uniform and gentle—so little accelerated by rapids—that when there is sufficient water to float the vessel, and sufficient power to govern it, the downward voyage may be performed without difficulty or danger in the channels as they were formed by nature; and the return trip might be made with equal security and success with very little aid from art."

Rain, a Source of the Nitrogen in Vegetation.

M. BARRAL, from some analyses of rain-water collected at two distinct spots in the grounds of the Observatory at Paris, during the last five and six months of the past year, has shown us that, the rain-water is there charged with nitric acid, ammonia, chlorine,

lime and magnesia, to an extent scarcely to be credited, were it not the actual result of experiment. Taking the average of these analyses, and reducing the French weights to our own standard of 7,000 grains to the pound, it will be seen, in these six months, the rain which fell on a space of ground at the Observatory at Paris, eqnal in area to an English acre, contained, as nearly as possible, 7.75 pounds of ammonia; 36.50 pounds of nitric acid; 5.56 pounds of chlorine; 12.60 pounds of lime; 4.81 pounds of magnesia.

From July to December is usually the drier half of the year, as well as that in which the less fuel is consumed, so that we may safely double these quantities, in estimating the annual supply per acre of nitrogeneous compounds, gradually distributed over the country by the rain. For the sake of illustration, we have calculated the amount of the solid constituents of the rain falling on an area equal in extent to Great Britain, and balancing the various causes likely to lessen or to increase the quantity of these matters, which would so fall on this island, we may venture to set one against the other, and apply the above statement to our own country, as the basis of an estimate, which singularly manifests the "power of littles," as well as the grand scale on which even the minutest of natural phenomena proceed. Thus, on the Parisian data, the weights of these fertilizing materials annually supplied to the soil of this island by the rain, amount to about 400,000 tons of ammonia; 1,850,000 tons of nitric acid; 279,000 tons of chlorine; 640,000 tons of lime; 244,000 tons of magnesia.

Making every allowance for errors of experiment, which, however, would rather increase than diminish these quantities, excepting, it may be, the amounts of the two last on the list, these researches of M. Barral prove to us that, the amount of fertilizing matter conveyed to the soil by the rain, must exercise a constant and most important influence on the vegetation of a country. These facts also tend to throw still further doubt upon the peculiar efficiency of the salts of ammonia, and of the acid of the nitrates as manures; for we find in rain-water a constant supply of these nitrogeneous matters, not applied once, or at most twice, in the year, as is the case with the various artificial manures, such as the nitrates of potash and of soda, Peruvian, and those guanos which contain a large proportion of soluble ammoniacal salts, and the various ammoniacal composts, made and sold in this country. the utility of which must chiefly depend on the concurrence of several favorable conditions of the plants, the soil and the weather; for we find that the nitrogen required for the growth of the plant is supplied in the fittest state for assimilation (viz., that of great dilution,) and at all stages of its growth, by every shower that falls. The later opinions entertained by Liebig, of the superior value of the alkaline and earthly constituents of manures, *i. e.*, the potash, soda, lime, magnesia, and the phosphates and sulphates of these bases, to that of their nitrogeneous compounds, derive much weight from these experiments of M. Barral, which show that a vast amount of nitrogeneous fertilizing matter is distributed by the rain but none of the fixed alkalies, or of the salts of phosphoric and other acids, equally important to the due growth of vegetables, and which, unless naturally existing in sufficient amount in the soil, must be supplied by the application of manure, or the plant will either dwindle, or yield an imperfect produce, owing to an insufficient supply of one portion of its requisite constituents, however much it may be stimulated by an abundant application of ammoniacal fertilizers. The prevailing use of these manures, which are so highly charged with the salts of ammonia, readily account for the increasing "steeliness" which is observable in English wheat, arising in great measure, as remarked by Liebig, from a superfluous and unnecessary supply of the ammoniacal stimulants, and a deficiency in the more important constituents of the cereals, viz., the earthy phosphates and alkaline salts, which are not brought to the growing corn in the rain, like the nitrogeneous constituents.—*London Critic.*

On Oxygen, by Professor Faraday.

Royal Institution, June 22nd.

The object of the speaker was to bring before the members, in the first place, M. Boussingault's endeavors to procure pure oxygen from the atmosphere in large quantities; so that being stored up in gasometers it might afterwards be applied to the many practical and useful purposes which suggest themselves at once, or which may hereafter be developed. The principle of the process is to heat baryta in close vessels and peroxidize it by the passage of a current of air; and afterwards by the application of the same heat, and a current of steam (with the same vessels), to evolve the extra portion of oxygen, and receive it in fitly adjusted gasometers: then the hydrated baryta so produced is dehydrated by a current of air passed over it at a somewhat higher temperature, and finally oxidized to excess by the continuance of the current at a lower temperature: and thus the process recurs again and again. The causes of failure in the progress of the investigation were described as detailed by M. Boussingault; the peculiar action of water illustrated; the reason why a mixture of baryta and lime, rather than pure baryta, should be used, was given; and the various other points in the *Memoire* of M. Boussingault were noticed in turn. That philosopher now prepares the oxygen for his laborotory use by the baryta process. The next subject consisted of the recent researches of MM. Fremy and E. Becquerel "On the Influence of the Electric Spark in converting pure dry Oxygen into ozone." The electric discharge from different sources produces this effect, but the high intensity spark of the electric machine is that best fitted for the purpose. When the spark contains the same electricity, its effect is proportionate to its length; for at two places of discharge in the same circuit, but with intervals of 1 and 2, the effect in producing ozone is as 1 and 2 also. A spark can act by *induction;* for, when it passes on the *outside* of a glass tube containing within dry oxygen, and hermetically sealed, the oxygen is partly converted into ozone. Using tubes of oxygen which either stood over a solution of iodide of potassium or, being hermetically sealed, contained the metal silver, the oxygen converted into ozone was absorbed; and the conversion of the *whole* of a given quantity of oxygen into ozone could be thus established. The effect for each spark is but small; 500,000 discharges were required to convert the oxygen in a tube about 7 inches long and 0.2 in diameter into ozone. For the details of this research, see the "*Annales de Chimie,*" 1852, xxxv. 62.—Mr. Faraday, then referred briefly to the recent views of Schonbein respecting the probable existence of part of the oxygen in oxy-compounds in the ozone state. Thus of the peroxide of iron, the third oxygen is considered by him as existing in the state of ozone; and of the oxygen in pernitrous acid, half, or the two latter proportions added when the red gas if formed from oxygen and nitrous gas, are supposed to be in the same state. Hence the peculiar chemical action of those bodies; which seems not to be accounted for by the idea of a bare adhesion of the last oxygen, inasmuch as a red heat cannot separate the third oxygen from the peroxide of iron; and hence also, according to M. Schonbein, certain effects of change of colour by heat, and certain other actions connected with magnetism, &c.

Mode of Manufacturing Artificial Essences.

Prof. Fehling, in the Wurtemberg *Journal of Industry,* gives the following abstract of what is at present generally known respecting the composition and production of some of the artificial extracts of fruit. He says:

Amongst the chemical preparations exposed at the London

Exhibition, the artificial extracts of fruits were particularly deserving of attention. Although some of these extracts, as for instance, butyric ether, have already found applications, their use has been hitherto only on a very limited scale. It is now, however, no longer to be doubted but that the majority of our artificial organic compositions will, ere long, be extensively applied, and their practical applications cannot but have a very stimulating effect on the study of organic chemistry, which will again most probably lead to the discovery of technical applications for the new organic compositions, which the investigations of our modern chemists have furnished us with. Among the extracts of fruit exhibited by a London manufacturer, those which more particularly attracted attention were pine apple oil, bergamot pear oil, apple oil, grape oil, cognac oil, &c. Several of these oils have been analyzed by M. Faiszt, of Stuttgardt. We give here a succinct description of some of these extracts, and of their manufacture.

Pine Apple Oil.—This product consists of a solution of 1 part of butyric acid ether, in 8 to 10 parts of spirits of wine. For preparing butyric acid ether, pure butyric acid is required, and this is obtained most readily and in greatest quantity, by the fermentation of sugar, or of St. John's bread, (*siliqua dulcis.*) For preparing butyric acid from sugar, M. Bentch takes a solution of 6 pounds of sugar, and half an ounce of tartaric acid in 26 pounds of water, which is left to stand for some days; at the same time about a quarter of a pound of old decayed cheese is diffused in 8 pounds of sour milk, from which the cream has been removed; and after this has also stood for some days, it is mixed with the first solution, and the whole is kept from four to six weeks at a temperature of about 24° to 28° Reaumer, water being added from time to time to replace that which is lost by evaporation. After the evolution of gas has entirely ceased, the liquid is dissolved with its own bulk of water, and finally 8 pounds of crystalized soda, dissolved in 12 pounds to 16 pounds of water are added to it. The liquid is then filtered and evaporated till it weighs only 10 pounds, when a quantity of 5½ pounds of sulphuric acid, (*nordhausen*, or fuming sulphuric acid,) diluted with 5½ pounds of water, is carefully mixed with it by small portions at a time. The butyric acid, in the state of an oily subtance, will now appear on the surface of the liquid, from which it may be skimmed off; but as the remaining liquid still contains some butyric acid, it is submitted to distillation, by which means another portion of diluted butyric acid is obtained, which may be be concentrated by means of melted chloride of calcium, or by saturating it with carbonate of soda, evaporating and decomposing by sulphuric acid. By this method 1¾ pounds of pure butyric acid are obtained from 6 pounds of sugar.

M. Marsson says that the same product may be obtained from St. John's bread (*siliqua dulcis,*) by taking 4 pounds of mashed St. John's bread, and mixing it with 10 pounds of water and 1 pound of chalk; the liquid matter must be maintained from three to four weeks at a temperature of from 25° to 35° Reaumer, and be often and well stirred, and from time to time the water that has evaporated must be replaced. After fermentation has ceased, a quantity of water equal to the bulk of the liquid is added and afterwards a concentrated solution of 2½ pounds or 2¾ pounds of carbonate of soda, when it is finally evaporated. To the concentrated liquid is then added 1½ pounds to 2 pounds of sulphuric acid, diluted with 2 pounds of water; and the remainder of the process is performed as already described. By this method a little more than half a pound of coloured butyric acid will be obtained. The acid, however, retains a peculiar smell from the St. John's bread, which continues even in the ether prepared from the same, whereas that prepared from sugar gives an ether of a very pure smell. It will be found advantageous to agitate the oily butyric acid with chloride of calcium, in order to deprive it entirely of its moisture.

For preparing butyric acid ether, (butyrate of oxyde of ethyle,) from butyric acid, 1 pound of butyric acid is dissolved in 1 pound of rectified alcohol, (95° Tralles,) and is mixed with one-half to one-fourth of an ounce of concentrated sulphuric acid; the compound is heated for some minutes, when the butyric acid ether will form a thin layer on the top. The whole is then mixed with half of its bulk of water, and the upper layer taken off; the remaining liquid being submitted to distillation, yields another quantity of butyric acid ether, which is mixed with that obtained in the first instance, and the whole well agitated with a very diluted solution of soda, in order to deprive it of all the acid; which operation should be repeated several times if a very pure ether is desired to be obtained. Care should be taken to use but small quantities of the diluted soda solution at a time, so as not to lose too much ether, this latter being in some measure soluble in water. When large quantities are to be acted upon, the washing water (*eau de lavage,*) is collected, mixed with an equal volume of spirits of wine, and distilled, by which means a solution of pure butyric acid ether in spirits of wine is obtained.

Butyric acid ether may be also obtained immediately from butyrate of soda, by dissolving 1 part of this salt in 1 part of rectified alcohol, adding 1 part of sulphuric acid, and heating some minutes. The ether collects on the top of the liquid, and is purified by washing with water and with diluted soda solution.

For preparing pine apple oil, 1 pound of butyric acid ether is dissolved in 8 pounds to 10 pounds of spirits of wine, which should have been previously deprived of its empyreumatic or fusel oil. Pure French spirits of wine will be found best suited for this purpose. According to the purpose for which the pine apple oil is to be applied, either rectified alcohol of 80° to 90° Tralles, or brandy of 40° to 50°, should be used for dissolving the ether. 20 drops to 25 drops of such an extract will suffice for giving a strong pine apple odour to 1 pound of sugar solution, to which some acid, such as tartaric or citric acid, is generally added.

Bergamot Pear Oil.—What is called pear oil is an alcoholic solution of acetate of oxyde of amyle, and acetate of oxyde of ethyle, prepared from potato fusel oil, (the hydrate of oxyde of amyle.) The potato fusel oil, or oil of potato spirits (in German, *fuseloel,*) is the compound distilled over towards the end of the first distillation of spirits made from potatoes, and is an oily liquid of a very strong and nauseous odor. This oil, in the state in which it is obtained from large potato brandy distilleries, is never pure; but it may be purified by agitating it with a diluted soda solution, when the pure fusel oil collects as an oily layer on the top of the liquid; this oily substance is then submitted to distillation, and that part which distils over at 100° to 112° Reaumer, is collected, and forms the pure fusel oil.

For preparing acetate of oxyde of amyle from this fusel oil, 1 pound of pure ice vinegar is mixed with an equal quantity of fusel oil, to which is added half a pound of sulphuric acid; the liquid is digested for some hours at about 100°, when the acetate of oxyde of amyle separates, particularly on being mixed with a small quantity of water. The remaining liquid, when mixed with more water, yields, on being submitted to distillation, a further quantity of acetate of oxyde of amyle. The entire mass of oxyde of amyle thus obtained is now agitated several times with water and a little soda solution, in order to deprive it of all free acid.

The acetate of oxyde of amyle may also be obtained by taking 1 part of fusel oil to 1½ part of dry acetate of soda, or 2 parts

hammer take all apart in a few minutes, and put them together in the same space of time.

There will be several sizes of these rams, from No. 1 up to No. 5; capable of throwing from 1 pint to 8 or 10 gallons per minute.

On the Variations of Temperature at Toronto.

To the Editor of the Canadian Journal.

PROVINCIAL MAGNETIC OBSERVATORY,
Toronto, August 2, 1853.

SIR,—

Having lately received through the kindness of Col. Sabine, a paper read by him before the Royal Society, (Feb. 10, 1853.) it has appeared to me of so much importance and interest, to Canadians especially, that I venture to lay before you the following account of it with a few accompanying comments. The title of this paper is

"*On the periodic and non-periodic variations of the Temperature at Toronto, in Canada, from* 1841 *to* 1852, *inclusive. By Col. Edward Sabine, Treas. and V.P.R.S.*

It may be regarded as an anticipation of the 2nd Volume of Observations at the Toronto Observatory, which has been prepared for publication by Col. Sabine, and is now forthcoming in a few weeks.

The terms *periodic* and *non-periodic*, though familiar enough to scientific ears, may require a little explanation for the general reader. The *temperature* at any place is understood to be that of the air as indicated by a thermometer placed at a certain elevation above the ground, usually four or five feet, at the observer's station: the thermometer must be screened from the Sun's rays, and distant from any object capable of reflecting or radiating heat; it should also be exposed to a free current of air on all sides, and must moreover be sheltered from the rain, snow, and in short as much as possible from all extraneous causes, which might mix up their effects on the temperature with that of the air. Strictly speaking, the instruments should also be protected from the heat radiated by the earth, but this is not the usual practice, and it is preferred to make separate observations of this element; no error can arise from this cause, the custom being universal. It is evident that the fulfilment of all these conditions is extremely difficult, and no plan of exposing thermometers has yet been discovered which is free from objection. The thermometers at the Toronto Observatory, are situated on the North end of the building, and sheltered by a double shed of Venetian blinds, with many precautionary details which need not be entered into, but after all, the position cannot be deemed perfectly satisfactory; in the daytime they are read by a telescope through a window, but at night the observer is compelled to approach them with a light and read with the naked eye: this plan, which is very objectionable, it is intended to alter, the effect of it has undoubtedly been to make the night-temperatures higher than they should be, the thermometers being so sensitive that the heat of the observer's person during even the short period necessary for reading them, causes the mercury to rise sensibly. With regard to the difficulties which arose in an early stage of the observations, from the mechanical imperfections of the instruments, I would refer to an excellent article by Captain Lefroy, in the 2nd and 3rd numbers of the Canadian Journal: until very lately, those made by English makers were in general altogether untrustworthy, and in fact until the establishment of the Kew Observatory, where standard thermometers can now be obtained at the low rate of $5 each, there could not be said to exist any English standard. I would here reiterate Capt. Lefroy's warning to all who may be inclined to make meteorological observations, to put no confidence in thermometers where the graduation is not cut on the glass stem itself, and to remember that for the purposes of scientific investigation, the common cheap thermometers are worse than useless.

It should also be remarked that the day in all the following remarks is reckoned from 6 A. M. to 6 A. M.: the reason of this is to be sought for in the original plan of the Colonial observatories. Their especial object was to procure magnetic values in different parts of the world, at the same instant of absolute time, and the astronomical day at Göttingen from noon to noon was chosen as the day of reference for all the stations. As a connection between the magnetic and meteorological changes at the different stations was anticipated, the latter were made simultaneous with the former, and the noon of Göttingen happening to coincide very nearly with 6 A. M. at Toronto, our day is made to commence with that hour.

Coming now to the general question of variations of temperature, some of them are so obvious and familiar, as to require no pointing out, such as the increase in the morning and decrease towards night: by watching, however, a sensitive thermometer continuously for a short time, the column of mercury is seen to be almost constantly in a state of fluctuation, ascending and descending rapidly and repeatedly under the observer's eye, still on the whole, after the lapse of some minutes, sensibly altering its mean position in the tube, so that we may consider it to be always in a state of oscillation about a mean value which is itself in a state of ascent or descent, exactly resembling the small waves of the sea which alternately advance and retire while the great tide wave is steadily progressing. It is evident therefore, that noting the indication of the thermometer at one instant of time, will not give accurately the general temperature that pervades a sensible period including that instant; by actually watching the thermometer unceasingly, and recording all the changes that occur, we should evidently be able to eliminate the small and irregular variations, and deduce with certainty the *mean* temperature of the period, or that temperature which sustained uniformly throughout that period would be equivalent to the amount of heat which has been expended in producing the irregular changes actually occurring during the period. Such a mode of observation would not however be practicable, nor luckily is it necessary. By noting the temperature at certain equidistant periods of time, and with a frequency which experience has shown to be sufficient we may be certain that the effects of the irregular variations will sensibly counterbalance each other and leave us a mean result freed from their influence. Thus, experience has shewn that observations made every hour, or every two hours, will give with accuracy the mean temperature for the day; and the mean of all the daily means thus obtained in a year, will give with accuracy the mean temperature of that year, and the mean of a few years will give the mean annual temperature of the place. So also the mean of these annual temperatures at a considerable number of places on the same parallel of latitude gives the annual temperature for that latitude, and by extending the same process over all the parallels, we obtain finally the mean annual temperature of the whole surface of the earth, and can watch the changes that occur in it from year to year. When, however, we descend to the changes at the same place during the year, and compare them with those occurring at other places, the above process is no longer applicable. For this purpose the mean daily temperatures observed for a considerable number of years, are collected into monthly averages, and the intermediate temperatures are interpolated between these by Bessel's formula, so as to obtain the mean or normal annual march of the temperature. Again when the daily observations are taken at fewer times than hourly or two-

hourly, a mean of the observations will not give the true daily mean, and certain corrections must be applied to the individual observations, deduced from the known diurnal march of the temperature on that day: to effect this the observations at each hour for a series of years are separately collected into monthly averages, and the means thus obtained are used to furnish by interpolation the normal diurnal march on each day. In this way the normal diurnal curves being constructed for a sufficient number of places on each parallel of latitude, the mean curve for that latitude is found by graphical interpolation, and from the curves of all the latitudes, that for the whole surface of the earth is determined. It is thus that Professor Dove has been enabled to construct his well known isothermal maps, and to announce those striking results which have astonished and delighted all engaged in the pursuit of meteorology: I may refer the reader for information to Humboldt's *Cosmos*, to *Views of Nature*, and to Dove's *Verbreitung der Wärme*, and *Brit. Ass. Reports* for 1847-8.

This principle then of separating the changes of value of the meteorological elements into two classes—periodic—or those which recur in a determinate order,—and non-periodic—or those which may be considered accidental at the period of occurrence, and whose effect is to be eliminated from the mean result—so fertile in results and powerful in analysis, was first brought prominently into notice by Bessel and Gaüss, and has since been applied with eminent success by those distinguished philosophers, Dove and Col. Sabine. . . The non-periodic variations are those to which the attention of meteorologists will in future be mainly directed in connection with the whole subject of the windrose, which Dove has shewn to be the key of the great problem of climatology.

To proceed now to the paper which is the subject of this letter.

The first table given by Colonel Sabine, contains the temperature of each hour of the day, arranged in monthly means on the average of six years, from 1842 to 1848, and from this by Bessel's formula, he has calculated another table giving the corrections to be applied to the observed temperature at each hour of the day, for every five days throughout the year in order to deduce the mean temperature of the day, thus forming the normal diurnal march. His interesting remarks upon this table I give in full, but the limits of this note compel me to omit his novel and ingenious idea of chrono-iso-thermal curves.

"From the temperatures computed from the six years of observation we learn many facts regarding the temperature at Toronto which are interesting in themselves and may become particularly so in their comparison with the phenomena in other parts of the Globe.

"Amongst these may be noticed the following:—The mean annual range, or the difference between the mean temperatures of the coldest and the hottest month, (February and July) is 42°.7. The warmest day of the year is July 28, being thirty-seven days after the summer solstice, the coldest day is February 14, being fifty-five days after the winter solstice. The mean temperature of the year is passed through on April 19th and October 15th. The warmest and coldest days, and the days on which the mean temperature is passed through, deduced by a similar process at Konigsberg by Bessel, at Paris, Turin, and Padua by Kamtz, at Berlin by Mädler, and at Prague by Fritsch and Jelinek, are collected by the last named meteorologist in his memoir,—*On the daily march of the principal Meteorological elements, deduced from hourly observations at the Prague Observatory*, published in the Transactions of the Imperial Academy of Sciences at Vienna in 1850, and are as follows:—

	Maximum.	Minimum.	Days on which the mean temperature of the year is passed through.	
Konigsberg............	August 1...	January 9..	April 21...	October 20.
Berlin (18 years)......	July 18...	January 19..	April 19...	October 21.
Berlin (92 years)......	July 22...	January 12..	April 17...	October 16.
Prague (8 to 9 years).	July 24...	January 26..	April 16...	October 20.
Prague (76 years)....	July 23...	January 19..	April 15...	October 18.
Paris..................	July 28...	January 15..	April 18...	October 19.
Turin.................	July 27...	January 3..	April 18...	October 26.
Padua.................	July 26...	January 15..	April 20...	October 15.

These may be compared with the corresponding epochs at Toronto as derived respectively from the six-years and the twelve-years series discussed in this paper.

Toronto (1842.5 to 1848.5)..	July 28..	Feb'y. 14..	April 19..	October 15.
Toronto (1841 to 1852,)....	July 28..	Feb'y. 12..	April 25..	October 17.

The anomalous character of the North American Winter, so visible in the Chrono-iso-thermal Plate is also marked by the very late occurrence of the epoch of the *minimum* temperature, and the great dissimilarity in that respect from all other stations. The systematic character of this anomaly is further shown by the fact that every hour in the twenty-four has its minimum temperature between the 7th and 17th of February; the minimum occurs earliest, viz., on the 7th of February, at the hour of 2 P. M.; the minima of the hours of the night, or from 9 P. M. to 7. A. M. inclusive, fall the latest, viz., on the 15th, 16th and 17th of February; those of the intermediate hours on the intermediate days and in regular progression. The hours from 6 A. M. to 9 P. M. inclusive, or those of the *day*, have their maximum temperature between the 20th and 30th of July; those of the *night* or from 11 P. M. to 5. A. M. inclusive, from the 3rd to the 12th of August. The portion of the twenty-four hours which is warmer than the mean temperature of the day varies considerably at different seasons; in part of November there are fourteen of the observation hours colder, and only ten warmer than the mean temperature of the day; in the greater part of July twelve of the observation hours are colder and twelve warmer; and in all the rest of the year thirteen hours are colder and eleven warmer. On the average of the whole year the mean temperature is passed through about 8h. 31m. A.M., and 7h. 44m. P.M., making intervals of 11h. 13m. and 12h. 47m. The hours from 9 P. M. to 7. A. M. inclusive, are throughout the year colder than the mean temperature of the day; those from 10 A. M. to 7 P. M. are throughout the year warmer than the mean temperature of the day; 8 and 9 A. M., and 8 P. M., are sometimes warmer and sometimes colder than the mean temperature: 8 A. M. is colder except for about three weeks in July, and 9 A. M. is warmer except from November 20 to March 11; 8 P. M. is colder from the middle of March till late in November, and either coincides with the mean temperature, or is slightly warmer during the remainder of the year.

The hours of the highest and lowest temperature on every fifth day of the year, and the amount by which the temperature at those hours exceeds or falls short of the mean temperature of the day may be examined in detail in the Table. From the third week of September until April, 2 P. M. is the warmest hour, with the exception of some days in January and February, when 3 P. M. is warmer: from April to the middle of May, and again from the end of July to the middle of September 3 P. M. is the warmest hour; and from the middle of May to the middle of July, 4 P. M. The coldest hour from the latter part of April to the end of June, and again from the end of October to late in November is 4 A. M.; from the middle of July to the middle of October, in January, and for a short time in the middle April it is 5 A. M.; from the latter end of February to early in April it is 6 A. M.; and generally in December and February 7

A. M. The range from the minimum to the maximum in the day is greatest in July (18°.2,) and least at the end of December (5°.2). The daily range has but one maximum in the year, which is in July; not as at Prague, where June and July have a less range than the months immediately preceding and following them, and where consequently there are two maxima, a phenomenon attributed to greater prevalence of the clouds in June and July.

[The following are the mean daily ranges of temperature for the several months; they must be carefully distinguished from the ranges of the whole months separately, these latter being the differences between the highest and lowest temperatures occuring in each month.

	°		°		°
January	5.78	May	15.13	September	13.80
February	9.38	June	15.69	October	10.88
March	10.22	July	18.21	November	6.68
April	11.97	August	16.27	December	5.98

Mean daily range on the average of the whole year 11°.41.]

It may be desirable to add a few words on the assistance to observers of tables which furnish corrections to the mean temperature of the day for every hour of every day in the year, such as the table spoken of. Besides their direct use at the station itself, they have a useful bearing within a reasonable distance from the station, on the selection of observation hours in the many cases in which it may not be possible to observe at hourly or two-hourly intervals, by affording a ready means of estimating the amount of error to which a deduction from any limited combination of hours is subject. If we desire, for example, to seek the observation hours within the command of a single observer, which may give the best approximation to the mean temperature of the day, and to that of the month, and of the year, as well as to *climatic* difference (i. e., the difference between the hottest and the coldest months), we find that, of homonymous hours, the best pairs at Toronto are 9^h—9^h and 10^h—10^h, 10^h—10^h being the better of the two; but that 8^h—8^h, which is a combination frequently adopted by observers, does not suit so well at Toronto as either 9^h—9^h or 10^h—10^h.

For the purpose of combining with an approximate mean temperature of the day an approximation to the hottest and coldest hours of the day, and to the hours of maximum and minimum of other meteorological elements—three equidistant observations are frequently adopted in preference to a binary system, and the hours of 6 a.m, 2 p.m., and 10 p.m., appear to be usually preferred. These hours are still within the command of a single observer, though we often find substituted for them the non-equidistant hours of 7 a.m., 2, p.m. and 9 p.m., doubtless because they suit better the convenience of observers. In comparing the mean temperatures in the different months derived from 6^h, 2^h, 10^h, or 7^h, 2^h, 9^h, with the full complement of twenty-four hours, we find that the approximation to the mean temperature obtained by 7^h, 2^h, 9^h, is not quite so good as by 6^h, 2^h, 10^h; and that either of the triplets gives a less correct mean temperature than 10^h—10^h: $6\frac{1}{2}$, 2, $9\frac{1}{2}$, would appear a more suitable combination as far as regards approximation to the mean temperature.

Three equidistant observations in the twenty-four hours are the utmost that can be perseveringly maintained by a single observer. When there are two or more observers there is no difficulty in multiplying the times of observation so as to comprehend all the objects that may be desired, each in the manner and by the means which are most suitable to it, and will be most satisfactory. But as the work of observation at by far the greater number of meteorological stations is usually carried out by a single observer, and as this is likely to be always the case, it should be a primary object with meteorologists who are furnished with sufficient means, to form tables of corrections to the mean daily temperature for every hour of the day, upon the basis of a sufficient number of years of observation, to be used at the respective localities, or within the distances to which such tables may be severally applicable by persons whose means or convenience may restrict them in respect to the number and choice of hours of observation.

With such a table, the choice is disembarrassed of its chief difficulty, that of selecting hours which by their combination will give an approximate mean temperature for the several months and for the year; and the observer is left free to give a preference, independent of such consideration, either to the hours when the phenomena change least rapidly, and consequently small irregularities in the times of observation will be least injurious, or to the hours which will furnish the best approximation to the daily maxima and minima of the meteorological elements generally, viz.: of the temperature, the tension of vapour, the pressure of the gaseous atmosphere, and the force of the wind; or to the hours which will have the most effective bearing upon other points of meteorological or climatic interest, to which the observer's attention may be directed."

Having thus obtained the necessary corrections for all the the hours, they have been applied to the observations individually, during the next 6 years in which the hourly system of observation was abandoned. The daily means of the whole 12 years were then collected into monthly averages, and Bessel's formula was used to obtain the mean normal temperature for each day of the year. These are entered in table IV along with the differences between these normals and the observed means of each day for the whole 12 years—being in fact the non-periodic variations for these days—and also a column with the average of these differences, or the average non-periodic variation for each day. On this Colonel Sabine remarks:

"We may learn consequently from this column the average non-periodic variation in twelve years of any particular day of the year which may be surmised to be subject to some special physical peculiarity, causing it to be warmer or colder than the general progression of the temperature in the part of the year to which it belongs. An example of its application may be given by the reply which the values in this column furnish to the question, whether the three days of May (the 11th, 12th, and 13th,) which Mädler has stated to be characterised, on the average of 86 years of observation at Berlin, by a depression exceeding 2° Fahr., when compared with the general march of the temperature at that season, undergo a similar depression in North America. On a reference to the month of May in the table, it is seen in the final column that on the average of 12 years from 1841 to 1852, the 11th of May was 0·1 *below*, and on the 12th and 13th of May respectively 3°·1 and 2°·4 *above* the general mean of the temperature in those years. It may be seen also that the average non-periodic variation in the five days from the 8th to the 12th of May inclusive, is in the same 12 years, 1°·1 *above*, and in the five days from the 13th to the 17th inclusive, 1°·1 *above*, the general mean of the temperature. The meteorological observations at Toronto during these 12 years do not therefore support the supposition that the depression of temperature on the 11th, 12th and 13th of May, observed at Berlin, is a general and periodically recurring phenomenon over the whole globe, such as would be occasioned by a partial obscuration of the Sun's disc by the intervention of a periodical stream of aerolites; but they tend rather to indicate that the depression observed in Europe may have been a partial phenomenon, having a local cause."

From the tables mentioned, I have computed by interpolation the normal values for each hour of observation at Toronto on every day in the year, the differences between which and the ac-

tual observed values are entered in a column of the register, thus shewing at a glance the non-periodic variation at that time. In this form the monthly meteorological reports will in future appear in the Upper Canada Medical Journal.

The mean monthly temperatures on which these calculations are founded are as follows:—

	°		°		°
January,	24·97	May,	51·18	September,	58·02
February,	23·40	June,	61·05	October,	44·93
March,	30·23	July,	66·41	November,	36.51
April,	41·14	August,	66·16	December,	26·75

July is consequently the hottest month, and February the coldest; there are 6 months above and 6 months below the mean of the year (44°·23), and the mean temperature is passed through in April and October. The hottest month is 22°·18 *above*, and the coldest month 20°·83 *below* the mean, the difference between the hottest and coldest months being 43°·01.

Col. Sabine remarks that "February and March appear to be months most liable to extreme variations; July and August the least so." But it may be doubted whether the series of years is sufficiently long to warrant this conclusion. On a comparison of the iso-thermal curves over the whole surface of the earth, Dove states that September is "the season when the distribution of temperature over the globe is most regular, even America forming no exception. Then begins the Indian Summer, *the time which the Great Spirit of the Red-Skin sends to him that he may follow the chase.* Nature falls gently asleep in Autumn, and awakens with feverish starts in Spring."

On the yearly mean, Col. Sabine states:—"The mean annual temperature derived from the whole body of the observations in twelve years is 44°·23; and on the supposition that no constant errors, instrumental or observational, or occasioned by insufficient protection or defective exposure of the thermometer, are involved, and that the variations of the temperature in different years may be regarded strictly as accidental oscillations round a mean value, and of equally probable occurrence in every year, the probable error of this result is ±0°·18. The probable variability of a *single year* is +0°·63, shewing that there is an equal chance that the mean temperature of any one year will fall within the limits of 43°·60 and 44°·86, as that it will exceed those limits; a conclusion which, perhaps, would scarcely have been anticipated, considering the great range of the thermometer in the course of the year, and the magnitude of the non-periodic variations in short intervals. *The climate of Toronto presents a remarkable combination of great regularity in the annual temperature with great variability occurring in the course of the year.*

The mean temperatures of the several years differed from the average mean temperature as follows:—

	°		°		°
1841	—0·31	1845	+0·35	1849	—0·14
1842	—0·27	1846	+2·13	1850	+0·22
1843	—1·88	1847	—0·53	1851	—0·25
1844	+0·25	1848	+0·65	1852	—0·39

The excess of cold in 1843 (1°·88), was due chiefly to the occurrence of very low temperatures in February and March of that year; the excess of heat in 1846 (2°·13), was more generally diffused throughout the year, all the months except February and October being above their average."

On comparing the mean monthly temperatures with the normal temperatures due to the geographical latitude of Toronto, it appears that "every month of the year at Toronto is colder than the normal temperature of the parallel in which it is situated, the mean annual temperature being nearly 7° below the normal. The thermic anomaly is least in July and August (between 2° and 3°), and greatest in February, when it exceeds 11°. Its sudden increase in October and decrease in November are deserving of notice. In viewing the bearing of the thermic anomaly at Toronto on the more general question of the thermic anomaly in the part of North America in which it is situated, it is necessary to bear in mind that the thermometer at Toronto was about 342 feet above the sea level, equivalent, as usually estimated, to a diminution of rather more than 1° of Fahrenheit, on account of vertical elevation. Dove's normal temperatures are all reduced to the sea-level, and when the monthly temperatures at Toronto have undergone the same reduction, the thermic anomaly indicated by them is diminished to about 1° in July and August, but in February still reaches the large amount of 10°; in both respects, therefore, confirming Dove's conclusion, that the summers of North America are *not* warmer than is due to their latitude, whilst the winters are much colder." All these results are embodied in the accompanying plate, which is copied from that in Col. Sabine's paper.

The black curve line indicates the annual normal march of the temperature, its vertical ordinate being the number of degrees Fahr., corresponding to the period of the year indicated by the horizontal one.

The fainter straight lines give the actual observed averages of five-day periods for the twelve years, and the vertical distance between the two corresponding points of the faint and dark lines is the non-periodic variation at that period. The points surrounded by small circles are the actual monthly means of the twelve years from which the normal curve is computed, and these are connected by vertical lines with the corresponding monthly means (similarly distinguished), of the temperature due to the latitude of Toronto as calculated by Dove, the march of the latter being denoted by the dotted curve, and the vertical distances between this dotted curve and the dark one are the thermic anomalies for that period of the year. The normal geographical curve is computed for the sea level, but the normal curve itself is formed from the temperatures uncorrected for vertical elevation, so that in geographical comparisons of climate the thermic anomalies must be each diminished by about 1° Fahr.

An examination of these curves will prove highly interesting. I may especially direct attention to the rapid descent of the normal curve between November and December, its prolonged pause throughout most of January, (the *January* thaw) its sudden fall in February and its equally rapid rise in March.

As I have often heard it remarked that a cold winter is followed by a hot summer, I have thrown together the monthly temperatures into the usual seasons (December, January and February for winter, and so on), in the following table:—

YEAR.	SPRING.	SUMMER.	AUTUMN.	WINTER.
	°	°	°	°
1841	39·1	65·0	46·0	27·8
1842	42·7	62·0	44·7	22·6
1843	37·1	63·1	44·8	25·4
1844	44·1	63·4	42·4	26.9
1845	42·4	65·0	46·4	22.7
1846	44·2	66·6	49·8	24·1
1847	39·9	63·8	46·1	28.5
1848	41·3	65·9	45·0	22.4
1849	40·2	66·0	48·7	27·4
1850	38·4	66·7	46·9	24·9
1851	41·7	62·6	46·8	21·1
1852	39·1	64·5	47·2	26·3
Mean.	40·9	64·6	46·5	25·0

Probably the sequence may be better seen in the following form, where the difference of each summer above or below the mean of the summers is entered, and so also those of the winters in their proper order:—

41		42		43		44		45		46		47		48		49		50		51		52	
S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W
+0.4	+2.8	–2.6	–2.4	–1 5	+0 4	–1.2	+1.9	+0.1	–2.3	+2.0	–0.9	–0.8	+3.5	+1.3	–2.6	+1.4	+2.4	+2.1	–0.1	–2.0	–3.9	–0.1	+1.3

It will be seen from this that winters *above* the average *(mild,)* have been followed in two instances by summers *above (hot,)* and in three by summers *below (mild)* the average; and winters *below* the average (*cold,*) have been followed in two instances by hot summers, and in four by mild ones, so that the popular tradition is not at all supported by these observations.

This is not the place to discuss the subject of climate, but many of your readers will, perhaps, be interested in examining the following temperatures of a few places on the opposite shores of Lake Ontario. They are taken from Dove's tables, but are unreduced for both diurnal and annual variation.

It appears from these data (which, however, with the single exception of Toronto, are very rude for such a purpose), that as compared with these stations on the South side of the Lake, our increased severity of winter is much more than compensated for by diminished intensity in summer.

Place.	Spring.	Summer.	Autumn.	Winter.	Mean Annual Temp.
	°	°	°	°	°
Toronto	40·9	64·6	46·5	25·0	44·23
Hamilton	42·8	64·4	45·9	23.9	44.25
Kingston	41·7	67·7	48·7	18·7	44 17
Rochester	44·8	67·2	48·3	26·5	46·69
Fort Niagara	47·2	72·2	57·0	30·5	51·71
Oswego	41·1	65·9	45.7	24.7	44·36
Sackett's Harbor	44·3	69.7	53.	27·	48·50
Lewiston	45 7	68·3	49·9	27·0	47 73

I hope to discuss this subject more fully on a future occasion.

I am, Sir, yours respectfully,

J. B. CHERRIMAN.

Canadian Institute.

NOTICE TO MEMBERS AND SUBSCRIBERS TO THE JOURNAL.

It having been represented to the Postmaster General by the Council of the Canadian Institute, that the postage on the *Journal* was a heavy tax upon its publication, and that other Literary Periodicals published in Canada, enjoyed a total or partial immunity from that outlay, the Postmaster General has been pleased to order that the *Canadian Journal* may be transmitted to any part of Canada through the Post, at half the usual Postage.

The following gentlemen have been provisionally elected Members of the Institute by the Council. The customary formalities of their election cannot be complied with until the first General Meeting of the Institute in December next.

The Hon. Francis Hincks, Life Member, ... Quebec.
Mr. Edward Thompson, ... Toronto.
Mr. Albert Pellew Salter, P. L. S., ... "
Mr. Edward Robert Jones, P. L. S., ... "

Arrangements for the Session of 1853-4.

The Council of the Canadian Institute desirous of making arrangements to suit the convenience of gentlemen whose names are already on their list, as intending contributors of original papers to the Institute, during the Session of 1853-4, as well as of those who may have such an intention, but have not yet notified the Council to that effect, particularly request that the name and address of each intending contributor, together with the title of the paper he proposes to read or communicate, may be transmitted to the Secretary before the first day of November 1853. It will very much facilitate the arrangements of the Council if each contributor name the date of the Saturday on which it will be most convenient for him to submit his paper to the Institute.

Curves and Grades on the Ontario, Simcoe and Huron Railway between Toronto and Barrie.

	Length in Feet.	Length in Miles.
Curves of 5,730 ft. radius	8,567	1.62
do. 2,865 ft. do.	22,017	4.17
do. 2,292 ft. do.	560	0.106
do. 1,910 ft. do.	29,468	5.58
do. 1,432 ft. do.	5,247	0.99
	65,860	12.47
Tangents	273,768	51.85
	339,628	64.31

Ascents and Descents.—Toronto to Barrie.

	Ascent.	Descent.	Elevation of Summit above Lake Ontario.
Toronto to Summit	190,03 feet.	64,55 feet.	751,37 feet.
Summit to Barrie	325,37 "	584,02 "	
Total	1115,40 feet.	648,57 feet.	

Gradients in Feet per Mile, and lengths in Miles and Parts.

	60 ft.	50 to 60	40 to 50	20 to 40	0 to 20	Level	Total.	Total
Toronto to Summit	8 89	2.58	0.[illegible]	4.56	2.33	1.30	20.36	52.8
Summit to Barrie.	1.78	6.17	1.67	10.07	5.47	5.47	42.68	7.44

Maximum grade going North 60 feet per mile - - 10.67 miles.
" " " South 52.8 " " - - 7.44 "

CORRESPONDENCE.

Red-breasted Thrush.

To the Editor of the Canadian Journal.

SIR,—In the *Journal* for June, your correspondent, Mr. R. Whitwell, writes under the head "*Rara Avis*," concerning a well known migrating bird ("Robin Red-breast?") which was noticed by that gentleman to remain in this country throughout "the winter of 1851 and 1852." It must, certainly, have been a rare bird to remain behind the rest of its species, in a latitude where the mercury is often seen to fall "ten or twenty degrees below zero," where "the frigidity of the atmosphere had so thickened his blood and benumbed his frame, that he could not maintain his proper roosting position."

This "*last Robin of Summer*," must have had cause to remain with us during winter. The observer of this phenomenon writes without a pause to reason; however, he states that it is "very rare and uncommon, if not without a parallel," to see a bird of this species remain with us during winter. Might it not have been winged in the summer of 1851?—consequently, it would be a fruitless attempt for a wounded bird to migrate with its companions.

There are two species of this Thrush which migrate annually to Canada and the neighbouring colonies. Of one species, the male and female have red breasts, while the plumage of the other variety is dark, with very little red—but the latter are rare. Gosse, the author of the *Canadian Naturalist*, says: "I perceive no resemblance between him and our English Robin, except in the single circumstance of his having a red-breast.

I have devoted much attention to the natural habits of this bird which in Canada is vulgarly named a Robin,—in Newfoundland a Blackbird. It is, properly speaking, a species of the family TURDUS—Red-breasted Thrush (*Turdus Migratorius*) In many ways it resemble the English Blackbird (*Turdus Merula*) in habits and architecture. Since I begun to make observations on this branch of nature, in 1843, I have never seen a single bird of this species in the woods north of Toronto, later than the month of November. I fed one from the nest in 1846, which is still alive and healthy, and as far as I can judge, the variation of climate have taken little effect on its system—being kept in an equal temperature throughout the year; it sings in winter as well as summer.

Yours, &c.,

WM. COUPER.

Toronto, August 1st, 1853.

Notices of Books.

BOHN'S SCIENTIFIC LIBRARY.—The following numbers of that excellent series entitled Bohn's Scientific Library, have lately come under our notice, viz.: of the Bridgewater treatises, the volumes by Chalmers, Kidd and Whewell, Bacon's "Novum Organum," Oersted's "Soul in Nature," and Schomo's "Earth, Planets and Man," together with Kobell's "Sketches from the Mineral Kingdom." It is scarcely necessary to remark that all these works are published in Mr. Bohn's usual good style, but it may be well to allude to the fact that in the point of cheapness, they rival the publications of our American neighbours. Our English publishers are now very rightly endeavouring to issue standard valuable works at such a price as may place them within the reach of almost all classes of the community, while, at the same time there will be nothing to object to on the score of execution. In evidence of the success attending these effects, we may mention that we have lately purchased an English edition of a copyright work at a lower price than that demanded for a slightly inferior American reprint.

It will be scarcely necessary to do more than allude to the re-issue of the "Bridgewater Treatises," the elegant work of Dr. Chalmers on "The adaptation of External Causes to the moral and intellectual constitution of Man," the profound treatise of Whewell on "Astronomy and General Physics," and the interesting and instructive volume by Kidd, on "The adaption of Internal Nature to the physical condition of man," a kind of programme to the whole series of discourses relating to natural science—are all so well known and so thoroughly appreciated, that we need do no more than recommend the compendious form in which they have now been reproduced before us.

Bacon's *Novum Organum* is a work which, although of olden date, yet most worthily holds its place among the most valuable adjuncts to a student's library, and is equally deserving of the serious attention of the teacher and the philosopher.

Oersted's "Soul in Nature," is a work having somewhat the same objects as Hunt's "Panthea" and "Poetry of Science," and consists of a series of conversations between imaginary characters, on various points of art and science, interspersed with several of the author's speeches on various occasions. We candidly confess that we prefer the elegant and at the same time sufficiently profound works of our own countryman, to the abstract metaphysical disquisitions of the Danish philosopher, the high character of whose productions is in our mind considerably diminished by the colloquial form of most of the articles.

As an express of the German metaphysical school, and as the work of one of the most eminent philosophers of Europe, who from the lowest station raised himself by mere force of genius, to the highest position in science,—the "Soul in Nature," is well deserving of attention.

Schomo's work appeared some twelve years ago in the German translation from the Danish, under the title of Naturschilderungen, or Delineations of Nature, and attracted at the time, considerable attention. Some of the most interesting chapters are on Italian Malaria, Etna, Mountain Rambles in North and South, the various plants most useful to man, as for instance, the Bread fruit tree, the Cotton Plant, Flax, Coffee, Tea, &c., &c. The whole work is written in a pleasing style, and is well worthy of being placed beside Humboldt's "Aspects of Nature."

The second half of this volume contains a series of excellent lectures by Von Kobell, on "precious stones," "ordinary stones," "precious metals," and "ordinary metals," the several treatises are quite of a popular character, but at the same time contain a vast amount of very curious and valuable information, with regard to the history of many of the precious stones and metals, and with respect to mineralogy and geology generally.

We consider this to be one of the best selected volumes of the "Scientific Library."

THE ANGLO AMERICAN MAGAZINE,—*Published by Thomas Maclear, Toronto, August*, 1853.—The history of the War of 1812, is continued in the August number of this admirable periodical, with the same liveliness and perspicuity which distinguished former chapters. The successive descriptions of Canadian cities, will furnish when completed, the best tourists guide through Canada, that can be placed in the hands of the emigrant.

THE CANADIAN AGRICULTURIST,—*William McDougall, Toronto, Aug.*, 1853.—The Reports of the Discussions which take place at various meetings of Farmers' Clubs, and Agricultural Societies, and which now constantly appear in the *Agriculturist*, contain a large amount of information respecting the condition of husbandry in different neighbourhoods, and cannot fail to furnish many valuable hints, derived from observations and experience, to reading as well as to listening practical Farmers. We are glad to see that Mr. Kirkwood's mission to the United Kingdom, is likely to be productive of much good in various ways. We join in the request of the Agriculturist, that readers will notice that a Grand Provincial Exhibitton will be held in Montreal on the 27th, 28th, 29th, and 30th September, under the auspices of the

Agricultural Association of Lower Canada. The Annual Exhibition of the Agricultural Association of Upper Canada, will take place in the City of Hamilton, on October 4th, 5th, 6th and 7th. Both exhibitions will be open to competition from all parts of United Canada.

Naturalists' Calendar.

For April, May, June and July, Toronto, 1853.

BY WILLIAM COUPER.

BUTTERFLIES:		First seen.
Camberwell Beauty,	*Vanessa Antiopa*	April 9th
Black Swallow-tail,	*Papilio Asterius,*	" "
Clouded Sulphur,	*Colias Philodice,*	" "
Orange Comma,	*Grapta c Album,*	" "
Grey Vined White,	*Pontia Oleracea,*	May 14th
Tiger Swallow-tail,	*Papilio Turnus,*	" 28th
Small Copper,	*Lycæna Phleas,*	" 29th
Black Skipper,	*Thymele Brizo?*	" "
Small Spotted Meadow Brown,	*Hipparchia——?*	June 4th
Spring Azure,	*Polyommatus Lucia*	" "
The Archippus,	*Danais Archippus,*	" 6th
Pearl-border Fritillary,	*Melitæa Myrina,*	" 10th
Banded Purple	*Limenitis Arthemis,*	" "
Baltimore Fritillary,	*Melitæa Phaeton,*	" 15th

MOTHS:		
Great Saturnia (class *Attaci*) issue from cocoon,		May 24th
Saturnia Polyphemus issue from cocoon,		" 25th
Saturnia Promethcus issue from cocoon,		June 6th
Ghost Moth,	*Hipiolus Humuli,*	" "
Royal Tiger	*Arctia Virgo,*	" 9th
Buff Leopard,	*Arctia Isabella,*	" 14th
Twin-eyed Hawkmoth,	*Smerinthus Geminatus.*	" 20th
Eyed Hawkmoth,	*Smerinthus Ocellatus,*	" 24th
Panther,	*Spilosoma Acria,*	" "
Silver-spotted Buff,	*Pygæra Gibbosa,*	July 8th
Zebra Hawkmoth,	*Sphinx Kalmiæ,*	" 27th
Grey Hawkmoth,	*Sphinx Cinerea,*	" "

BIRDS:	
Little Grebe, (*Colymbus Minor,*) begins to build its nest—lays six whitish eggs,	April 30th
Ground Lark, begins to build its nest,	" 7th
Humming-birds,	May 7th
Red-winged Starling, (*Sturnus Predatorius,*) begins to build its nest,	May 18th
Whip-poor-will — *Caprimulgus Vociferus*	June 19th

MISCELLANEOUS:	
Gall-flies, (*Cynips Quercus folii*) deposit their *ova* in the leaves of the Oak,	May 28th
Racoon shot in the neighbouring woods,	" 14th
Tree Frog, (*Hyla Versicolor,*)	" 21st
Ephemera *Bioculata,* with two satæ at the tail, longer than the body,	June 9th
Field Cricket, (*Acheta Campestris,*) pipes its evening song,	" "
Star crane-fly, (*Bittacomorpha Crassipes*) deposits its *ova* in the earth	" 11th
Cuckoo-spit Insect, — *Tettigonia Spumaria,*	" "
Rattling Locust, — *Œdipoda Sulphurea?*	" "
Firefly, — *Lampyris Corusca,*	" 13th
Wild Strawberries — (*Fragaria Virginiana,*) ripe	" 11th
Blue-berries, ripe	July 8th
Tree-hopping Locust, — *Cicada——?*	" 13th
Wild Raspberries, — (*Rubus Idæus*) ripe,	" "
Wild Black Currant, — (*Ribes Floridum?*) ripe	" 28th
Wild Gooseberry, — (*Ribes Cynosbati,*) ripe	" 30th
Wild Blackberry, — (*Rubus Hispidus,*) ripe	" "

New Process of Photographic Engraving on Steel.

BY MR. FOX TALBOT.

I now proceed to give you an account of my newly invented method of making photographic engravings upon steel. Of course, I have no need to observe that the art is at present in its infancy, but I have great hopes that it will very soon be considerably improved in all its details.

The first thing to be done is to select a good steel plate, and to immerse it for a minute or two in a vessel containing vinegar mixed with a little sulphuric acid. The object of this is to diminish the too great polish of the surface; for otherwise the photographic preparation would not adhere well to the surface of the steel, but would peel off. The plate is then to be well washed and dried. Then, take some isinglass and dissolve it in hot water. The solution should be strong enough to coagulate when cold into a firm jelly. This solution of isinglass or gelatine should be strained while hot through a linen cloth to purify it. To this must be added about half as much of a saturated solution of bichromate of potash in water, and they should be well stirred together. When cold, this mixture coagulates into a jelly, which has very much the appearance of orange jelly. The method of using it is, liquify it by gentle heat. Then take a glass rod, hold it horizontally, and spread the liquid uniformly over the plate. Then incline the plate and pour off the superfluous gelatine. Let the steel plate be placed upon a stand, and kept quite horizontal, that the liquid may not run to one side of the plate. Then place a spirit lamp beneath the plate, and warm it gently till the gelatine is quite dried up. When dry, the film of the gelatine ought to be bright yellow and very uniform. If clouded bands appear upon the surface it is a sign that there is too little gelatine in proportion to the bichromate, which must therefore be corrected. The steel plate, now coated with gelatine, is ready to receive a photographic image of any object. First, let us suppose the object is one capable of being applied closely to the surface of the *plate;* for instance, let it be a piece of black lace or the leaf of a plant. Place the object upon the plate in a photographic copying frame, and screw them into close contact. Place this frame in the direct light of the sun for a short time, varying from half a minute to five minutes. Let it then be removed and the plate taken out, and it will be found impressed with a yellow image of the object upon a ground of a brown color, as might be expected from the well known photographic property of bichromate. The plate is then to be placed in a vessel of cold water for a minute or two, which dissolves out all the bichromate and most of the gelatine also from the photographic image, *i. e.* from those parts of the plate which have not been exposed to the sun, being protected by the object; while, on the contrary, it dissolves little or none of the gelatine film which has been fully exposed to the sun's rays. The consequence of whibh is, that instead of a yellow image we have now a white one, but still upon a ground of brown. The plate is then removed from the water into a vessel of alcohol for a minute, and it is then taken out and placed upright on its edge in a warm place, where in the course of a few minutes it becomes entirely dried. This terminates the photographic part of the operation. If the plate is carefully examined while in this state, it appears coated with gelatine of a yellowish brown color, and impressed with a white photographic image, which is often eminently beautiful, owing to the circumstance of its being raised above the level of the plate by the action of the water. Thus, for instance, the image of a piece of black lace looks like a real piece of very delicate white lace of similar pattern, closely adhering to, but plainly raised above, the brown and polished surface of the plate, which serves to display it very beautifully. At other times the white image of an object offers a varying display of light when examined by the light of a single candle, which indicates a peculiar molecular arrangement in the particles of gelatine. These photographic images are often so beautiful that the operator feels almost reluctant to destroy them by continuing the processs for engraving the plate.

In order to explain how such an engraving is possible, it is, in the first place, to be observed that the photographic image differs from the rest of the plate not only in color, but, what is of much more importance, in the thickness of the film of gelatine which covers it. The coating of gelatine on the rest of the plate is, comparatively speaking, a thick one, but that which originally covered the image has been mostly removed by the action of the water, a small portion, however, almost always remaining. It therefore naturally happens that when an etching liquid is poured on the plate, it first penetrates through the thin gelatine covering the image, and etches the steel plate beneath. But the next moment it penetrates likewise through the thicker coating of gelatine, and thus spoils the result by etching the whole of the plate. Nitric acid, for instance, does this, and therefore cannot be employed for the purpose. Since the other chemical liquids which are capable of etching steel have a certain analogy to nitric acid in their corrosive properties, they also for the most part are found to fail in the same manner.

This was a difficulty. But after some researches I found a liquid which etches steel perfectly well, and at the same time is free from the inconvenient property of penetrating the gelatine film. This liquid is the bichloride of platina. In order, however, to use it successfully, it must be mixed with a certain quantity of water, neither more nor less, (I mean to any material extent,) otherwise its action becomes irregular. The best way is, to make a perfectly saturated solution, and then add to it one-fourth of its bulk of water. Then correcting this by a few trials, a solution of proper strength is finally obtained. Supposing then, that we have prepared such a solution, the operation of etching the plate is performed as follows:—The plate is laid on a table, and a small quantity of the bichloride being poured upon it, it is to be rapidly diffused and spread over the whole plate with a camel hair brush. Not much liquid is poured on, because its opacity would prevent the operator from distinguishing the effect produced by it on the metal. For this reason, it is hardly necessary to make a wall of wax round the plate; that is, if the portions to be etched are confined to the central part of the plate, and do not approach very near to the edge. The effect of the liquid upon the plate is not at first visible, since it disengages no gas; but after the lapse of a minute or two, the white photographic image begins to darken, and soon becomes black in every part. When this change is complete, the image often looks very beautiful, though quite altered from what it was before. The operator should carefully watch the image until he thinks that it is finished, or not likely to be further improved or developed by continuing the process any longer. He then inclines the plate gently, and pours off the liquid by one corner of the plate. The plate is then dried with blotting paper, and then a stream of salt water, which is better than fresh water for this purpose, is poured over the plate, which removes all traces of the etching liquid. The plate is then rubbed with a wet sponge or linen cloth, which in a short time detaches and removes the film of gelatine, and discloses the etching that has been effected. When the object is not of a nature to be applied directly to the surface of the plate, the most obvious method of proceeding is, of course, to place the prepared plate in the focus of a camera, and to direct the camera to the object. But in consequence of the low degree of sensitiveness of bichromate of potash, this would take, generally speaking, too long a time to accomplish. The better way in practice, therefore, is, to take a negative photograph of the object on paper with a camera, and from this to obtain a positive copy either on glass or paper, which should be very uniform in texture, and moderately transparent. Then this positive copy is placed on the plate in a photographic copying frame, and being placed for a few minutes in the sun, it impresses the plate with a photographic image; which image, etched as above described, and printed off upon paper, will finally give a positive representation of the object. If the object depicted upon the plate by the sun's rays is broad and uniform, for instance, the opaque leaf of a plant, then, of course, the etching is uniform also. When this is printed off, it produces an effect which is not always satisfactory. I will therefore now explain a modification of the process which destroys this uniformity, and which in many cases produces a great improvement in the general effect.

For this purpose I must remark, in the first place, that if a piece of black gauze or crape is the object selected for representation, it produces an engraving of itself which is marvellously accurate. But when two folds of the gauze are laid across each other obliquely, then the resulting engraving requires a lens, in order to separate from each other and distinguish clearly the lines belonging to the two portions of the gauze. Now, if this engraving is printed off, the result offers to an eye at a moderate distance the appearance of an unifom shading. Now, I avail myself of this circumstance, to modify my original process as follows: suppose the object to be the opaque leaf of a plant, of irregular outline; first, I cover the prepared plate with two oblique folds of black crape or gauze, and place it in the sunshine for two or three minutes. The effect of this is, to cover the plate with a complicated image of lines passing in all directions. Then the leaf is substituted for the crape, and the plate is replaced in the sunshine for two or three minutes more. The leaf being then removed from the plate, it will be seen that the sun has obliterated all the lines that were visible on the parts of the plate exterior to the leaf, converting all those parts to a uniform brown. But the image of the leaf itself is still covered with a network of innumerable lines. Now, let this be etched in the way already described, and let the resulting etching be printed off. The result is an engraving of the leaf, which when beheld by the eye at a certain distance appears uniformly shaded, but when examined closely is found to be covered with lines very much resembling those produced by an engraver's tool, so much so that even a practical engraver would probably be deceived by the appearance. This crape arrangement I call a *photographic veil*: and as I think it likely that the idea will prove useful, I will make a few more remarks upon it. It is clear that an arrangement composed of two thicknesses of ordinary crape or gauze is but a rude attempt at a photographic veil. To realize the practical utility that may result from the idea, supposing it to be borne out by further experience, it would be proper to fabricate a much finer material, and to employ five or six thicknesses of it, or else to cover a sheet of glass in any convenient manner with an innumerable quantity of fine lines, or else with dots and specks, which must be opaque and distinct from each other. The result of practically employing such a method, supposing always that it answers in practice, as I think it probably will, would be an etching apparently uniform, but really consisting of separate small portions, in consequence of which it would hold the ink much better, and other obvious advantages would also be obtained. Another mode of accomplishing the same object is to cover the plate originally with an aquatint ground. But then a fresh one would be required for every plate, whereas a single *veil* would serve for any number of plates in succession. Experience alone can decide between these different methods. When the etching is finished, the plate should be very soon coated with wax to protect it. A few hours' exposure to the atmospheric air rusts and destroys the etchings when newly made, although it does not do so afterwards. The oxidation only attacks the lines of the etching, the rest of the plate sustaining no injury, if the air is tolerably dry.

Having thus described the method of producing the photographic etchings, it would, I think, extend this letter to too great a length were I to add any remarks upon the theory of the process, which will better be deferred to another opportunity.—*Athenæum.*

Lacock Abbey, April 25th.

Deodorizing Properties of Coffee.—The London Medical Gazette gives the result of numerous experiments with roasted coffee, proving that it is the most powerful means, not only of rendering animal and vegetable effluvia innocuous, but of actually destroying them. A room in which meat in an advanced degree of decomposition had been kept for some time, was instantly deprived of all smell, on an open coffee roaster, being carried through it containing a pound of coffee newly roasted. In another room exposing to the effluvium occasioned by the clearing out of a cess pit, so that sulphuretted hydrogen and ammonia in great quantities could be chemically detected, the stench was completely removed within half a minute, on the employment of three ounces of fresh roasted coffee, whilst the other parts of the house were permanently cleared of the same smell by being simply traversed with the coffee roaster, although the cleansing of the cess pit continued several hours after.

The best mode of using the coffee as a disinfectant is to dry the raw bean, pound it in a mortar, and then roast the powder on a moderately heated iron plate until it assumes a dark brown tint, when it is fit for use. Then sprinkle it in sinks or cess pools, or lay it on a plate in the room which you wish to have purified. Coffee acid or coffee oil acts more readily in minute quantities.

CANADIAN EXPORTS OF WHEAT.

Year.	Wheat. Bushels.
1838	296,020
1839	249,471
1840	1,739,119
1841	2,313,836
1842	1,678,102
1843	1,193,918
1844	2,350,018
1845	2,597,392
1846	3,312,757
1847	3,883,156
1848	2,248,016
1849	3,645,320
1850	4,547,224
1851	4,275,896
1852	5,496,718

It appears by the above statement that our exports of wheat in 1852 were about eighteen times as great as they were in 1838. They have doubled four times in fifteen years, or more than once in every four years for the last fifteen years. They are now one-half as much as the exports of wheat from the United States; and at the present ratio of increase—doubling in every four years—*our exports of wheat will, in* 1856, *be equal to those of the United States.—Leader*

Sir John Franklin.—To those whose knowledge is obtained, and whose judgment is formed, at the fire side, this may indeed appear to be a wild and hopeless expedition; but those whose practical knowledge is derived from exploration, scientific research, and hard experience in those regions towards which our course is now directed, have formed a far different opinion, and their acquisition of knowledge constitutes them the best judges, for in their belief the probability amounts to all but certainty, that either Sir John Franklin, or at least the greater part of his brave band, and most likely all of them, are still alive, and

may yet be restored to their families, their friends, and to the world. Against this probability are only to be placed the mutations and chances to which, under ordinary circumstances, human life is everywhere liable; for it is almost certain that Sir John Franklin and his noble crew could not have not been exposed to danger arising from any catastrophe; icebergs in the region to which he has been traced, are things unknown, nor yet are there seas there, in a nautical sense, by which their lives would be imperilled; the only accident that could befall them, would be from the sudden closing in of the ice, characterized by the term of "nipping," but even from that there are almost always time and means to afford escape; and consequently, a carefully formed opinion, based on reliable *data*, is now entertained among scientific and experienced men—such as Sir Roderick Murchison, and Commander Parry of your own nation, and of numbers among us, whose practical knowledge of those regions adds weight to the authority,—that this little band of martyrs to science, or at any rate, the greater part of them, are still alive, and, if the search be faithfully persevered in, that they will yet be found.—*Speech of Dr. Kane, of the Grinnell Arctic Expedition.*

Progress of the Electric Telegraph.—The Mediterranean Electric Telegraph Company, propose to unite Europe with Africa by continuing the electric wires, which now run without interruption between London and Genoa, to Spezzia. From the latter port they will cross the Mediterranean to Africa, passing by the islands of Corsica and Sardinia. It is further proposed to construct a subterranean line from Algeria, along the coast of Africa to Alexandria; and, with the support of the British Government and the East India Company, it will be easy to prolong the wires to Bombay, where they will meet the great line of 3,000 miles now in course of construction by the East India Company. The farther end of this chain may ultimately be carried to Australia.

Sanitary Properties of Wool.—Professor Simpson, of Edinburgh, has been the means of bringing to light a curious corroboration of the sanitary value of the ancient practice of annointing with oil. It appears, that the learned Professor, when recently visiting the manufacturing town of Galashiels, was casually informed that the workers in the wool-mill in that place were exempt from the attacks of consumption and scrofula. On inquiring of the medical men in the vicinity, the truth of the statement was confirmed, and it was then deemed expedient to pursue investigation on a broader scale. Communications were accordingly sent to physicians residing in Dunfermline, Alloa, Tillicoultry, Inverness, and other districts where wool-mills are in operation; and in the case of all, it was ascertained that similar immunity was enjoyed from the fatal diseases mentioned. It further appeared that, in some of the localities, scarlatina, only preserved health; but children of delicate constitution were sent to the wool-workers for the express purpose of acquiring strength—a result in almost every instance attained.

Extract from Dr. Owen's Report on Wisconsin—It had been usually believed, up to the date of my Annual Report of 1848, that the lowest members of the sandstone formation of which I am now speaking, were devoid of fossils. The geologists of our own country had set down the Lingula beds of the New York Potsdam Standstone as the oldest fossilferous rocks in the United States. And, in Europe, with the exception of the *Obolus Appolinis* of Eichwald, abundantly found in the inferior sandstones of the protozoic strata of Russia, no fossils whatever, (according to any established system) had been described or discovered beneath what has been usually regarded as the equivalent of the above named Lingula beds. I am now able to exhibit a new and interesting geological feature with regard to this formation. The present survey has brought to light the fact, that in Western America, are found stratra underlying coarse Lingula grits, and at a depth of seventy-five to one hundred feet beneath them, which are highly fossiliferous, and contain not the *Lingula* and *Obolus* alone, but *Orbiculus*, *Trilobites*, and compressed subconical bodies, resembling some forms of *Cephalopoda*, but probably not actually of that order. The sedimentary strata, in which, on the Mississippi and most of its tributaries, these fossils occur, either rest immediately on the igneous rocks of Wisconsin, or are separated from them by an inconsiderable thickness of chlorite and ferruginous slates; and are, in all probability the oldest fossil bearing rocks yet brought to light in any part of this Continent, if not of the world

Dr. Owen's Description of a new mode of Drawing Fossils.—The fossil itself serve as a guide and model to work from. After the specimen is fixed permanently on the machine, ore arm, pointed with steel, traverses all its inequalities of surface, in close parallel waving lines, and imparts a corresponding movement to a diamond point, in contact with the steel plate, which cuts similar lines through the prepared asphaltum surface down and slightly into the steel plate; subsequently these lines are corroded deeper—in the language of the engraver, bitten—into the metal by means of dilute nitric acid. Thus is produced an engraving, in a delicate silvery effect of light and shadow, capable of giving, if desired, 100,000 impressions of as perfect a counterpart of the original as can be accomplished by the daguerreotype process, provided the subject has not too great relief and can be placed in a horizontal position in the machine.

Though the plates in this work are the first application of this art to the representation of fossil remains, it has been a wonderfully successful experiment which will doubtless be the means of its introduction whenever the form and character of the subjects admit of its application. All structure visible to the naked eye can be brought out by this process; and minuter structure, indistinctly visible to the unassisted eye, can be worked up by a skillful artist, after the plate comes from the machine.

Loss of Sulphur in Smelting Ores.—The *Cornwall Gazette*, after quoting our description in the Journal, of 19th March, of Mr. Andrew Crosse's patent for extracting metals from their ores by electricity, alludes to the great advantages which would ensue nationally were measures adopted for securing the sulphur contained in a majority of the copper ores, now dissipated in the atmosphere by the present mode of roasting the ores for smelting. The principal portion of the copper ores of Cornwall are pyrites, containing in addition to the copper and earthly matters, a considerable portion of iron and a large amount of sulphur. The iron is comparatively of little value, and would not pay for recovering; but taking the copper pyrites at 12,000 tons per month, probably near the average, 18,000 tons of sulphur are wasted per annum, which, by proper chemically scientific principles, might be saved, increase the mineral wealth of the counties of Cornwall and Devon by £150,000 a year, render us to a certain extent independent of Sicily and the copper smelting works cease to be the destructive nuisances which they are at present. We have, on many previous occasions, in former years inserted valuable correspondence on this subject from Messrs. Leishton, Prideaux, Birkmyre, and others; and still consider it of much national importance, and worthy of scientific and experimental research.—*Mining Journal.*

Permeability of Metals by Mercury.—M. J. Nickles, in experiments on the metals, has discovered that those which will form an amalgam with mercury are easily permeated by it. Horsford and others establish the permeability of tin, lead, gold, silver, zinc, and cadmium, to which M. Nickles adds copper and brass. This fact was discovered by accident—he was using a Bunsen's battery ; the connecting pieces of copper were rivetted to the zinc, and on amalgamating the latter metal it often happened that the mercury spread itself over the copper, and after a certain time this latter metal became brittle, having a white fracture, proving itself an amalgam. With a stylet, he then traced a furrow on plates to be experimented on, and placed a little mercury therein. In order to hasten the amalgamation, a drop of bi-chloride of mercury, acidified with hydro-chloric acid, is introduced By this means the amalgamation takes place instantly, and the surface is fitted to retain at once the quantity of mercury necessary to produce the effect.

Occasional Readings

Of two Thermometers, one with blackened bulb, the other unblackened, laid on the grass in front of the Provincial Observatory door, facing South, with the tops of the Thermometer slightly raised, and corresponding readings of the standard Thermometer in the shade, with Northern aspect.

August, 1853.	Time.	Sun. Black Bulb.	Sun. un-bl'ked	Sh'de. Stand.
10th. Mean 76°·98	Noon	130°5	111.4	87°·5
	12 15	136·2	114 5	88 0
Max 88°·6 } R'ge 23°6	12·30	112 6	100·2	87·9
Min.65°·0 }	12 45	130·8	117 8	88·2
	1·00	132 5	118·5	88 4
11th.	11.00	129 4	111.2	85·9
Mean 79°·25	12·00	123 8	109 2	88·1
	12·30	131 0	113·0	89 0
Max.94°·9 } R'ge 25°5	1 00	116·8	106·5	89 2
Min.69°·4 }	2 30	119 2	110·8	91 6
	3 30	103.8	98·5	89 9
12th.	10·40	117·0	106 0	87 0
Mean 79°·83	11·00	126·0	112 4	88 2
	11 30	110 0	100 0	86 8
Max .1°·6 } R'ge 22°1	noon	118·0	104·4	87 6
Min. 69°·5 }	12 30	125 0	109 0	90·0
	10 30	111·0	104·0	83·6
13th.	10 50	118 0	110.0	84·2
Mean 78°·53	11·30	122 0	112 0	84 7
	12·00	123·0	115 0	86 2
Max. 90°·8 } Rg'e 19°8	12 20	121·0	113·0	87 6
Min. 71°·0 }	12·40	122·0	108·0	87·7

Monthly Meteorological Register, St. Martin, at Isle Jesus, Canada East, July, 1853.

Nine Miles West of Montreal.

[BY CHARLES SMALLWOOD, M. D.]

*Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 ft.**

Day.	Barom: corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapour.			Humi'y of the Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Weather, &c. A cloudy sky is represented by 10; a cloudless sky by 0.			REMARKS.
	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2. P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.		6 A. M.	2 P. M.	10 P. M.	
1	29.573	29.504	29.518	67.2	75.6	60.0	0.534	0.498	0.350	.81	.58	.66	N W b N	N W b N	N W b N	6.96	5.33	12.05		Clear.	Cum. Str. 5.	Clear.	
2	.792	.627	.648	60.0	74.7	63.1	.360	.435	.470	.68	.52	.80	N b W	N W	N E b E	3.16	5.37	3.75		Clear.	Clear.	Clear.	
3	.642	.501	.425	67.6	74.2	68.0	.455	.648	.650	.69	.78	.98	E b N	S S E	S E	1.15.	7.50	2.30	0.436	Clear.	Rain.	Cm. Str. 9.	
4	.471	.369	.412	68.0	81.9	64.0	.646	.659	.542	.94	.61	.92	SE b E	S W	S b E	2.08	7.57	5.50	0.918	Cir. Str. 8.	Cum'l. 4.	Showers.	
5	.423	.392	.552	65.4	70.9	63.2	.449	.506	.435	.72	.67	.75	W b S	W b N	W	5.00	8.61	4.99		Clear.	Cir. Str. 6.	Str. 6.	
6	.544	.555	.684	63.1	74.0	58.4	.461	.373	.308	.79	.45	.63	W N W	W N W	N W b W	6.81	9.29	12.70		Cum Str. 4.	Clear.	Clear.	
7	.795	.790	.720	50.0	71.6	56.4	.304	.414	.432	.81	.55	.94	N W b W	N W b W	S W b S	2.50	10.89	5.00		Clear.	Clear.	Clear.	Very Faint Aurora.
8	.634	.604	.503	58.0	72.9	69.9	.412	.532	.541	.84	.53	.74	S b W	W S W	W S W	2.06	8.15	10.15	0.080	Cum. Str. 6.	Cum. Str. 8.	C. Str. 2.	
9	.586	.535	.515	64.1	78.4	67.6	.450	.550	.534	.75	.58	.81	W S W	W S W	S W b W	7 30	5.16	5.03		Clear.	C.C. St. 8.	Clear.	
10	.597	.497	.499	65.6	83.4	66.2	.499	.532	.440	.80	.48	.68	W S W	W S W	W S W	5.20	7.12	3.34		Light Cir.	Clear.	Clear.	Aurora Borealis.
11	.577	.536	.614	64.0	77.6	60.9	.450	.458	.393	.75	.50	.75	W N W	W N W	N	1.15	4.60	4.98		Clear.	Cuml. Str. 4	Clear.	Aurora Borealis.
12	.721	.698	.700	57.0	68.6	60.3	.355	.379	.416	.74	.55	.79	N N W	N b E	N b W	4.33	3.80	1.00		Cirr. Str. 2.	Cuml. Str. 8.	Clear.	Aurora Borealis.
13	.785	.697	.700	60.4	80.8	62.8	.416	.787	.445	.79	.78	.79	N E	S E	S E	0 03	1.75	0.82		Clear.	Clear.	Clear.	
14	.722	.585	.543	57.0	85.5	67.1	.422	.597	.506	.89	.50	.76	S E	W b S	S b W	Calm.	2.00	Calm.		Clear.	Clear.	Hazy.	
15	.445	.333	.233	64.0	82.2	73.8	.460	.599	.489	.78	.55	.61	S b E	S b W	W b N	1.24	2.62	4.12	Inap.	Light Cirr.	Cuml. Str. 4.	Rain 9.40.	
16	.210	.183	.282	68.5	80.8	62.2	.646	.648	.472	.96	.64	.84	E N E	W	W	1.59	7 89	8.95	0.556	T. S. 1 a. m.	Cir. Str. 2.	Cir. Str. 8.	Thunder Stm. 1 a.m
17	.358	.405	.426	56.1	64.0	61.0	.385	425	.456	.84	.71	.84	W N W	W	W	0.28	10.00	8.06		Str. 8.	Str. 4.	Str. 6.	
18	.587	.545	.574	61.6	77.0	63.7	.407	.506	.488	.75	.55	.84	W	W	E S E	Calm.	0.10	0.10		Cl., Au.B 1.	Clear.	Cir. 4	Aur. Bor. 1 a.m.
19	.605	.602	.570	57.7	70.0	63.7	.462	.541	.568	.94	.74	.84	N E	E N E	N E	0.37	0.37	3.60		Cirr. Str. 8.	Cuml. St. 5.	Rain 8·45.	P. M.
20	.465	.450	.508	62.4	73.3	60.2	.499	.515	.467	.89	.64	.89	W	N b W	N	6.29	0.88	3.75	0.403	Cirr. Str. 6.	Cuml. Str. 5	Sh. 4·50.	P. M.
21	.443	.377	.389	56.4	86.0	70.8	.432	.681	.468	.94	.56	.78	W	S W b W	W	1.50	4.75	2.12		Clear.	Clear.	Clear.	
22	.440	.369	.369	68.0	90.4	70.1	.523	.578	.541	.76	.42	.74	W S W	W S W	S W b S	1.45	2.84	2.00		Clear.	Clear.	Clear.	
23	.376	.294	.278	69.1	92.9	70.5	.486	.550	.628	.69	.40	.86	W	W	S b W	0.82	1.57	0.89		Clear.	Clear.	Clear.	Faint Aurora.
24	.309	.259	.243	69.1	91.0	72.2	.513	.739	.578	.72	.53	.74	W	W S W	S b W	1.45	3.30	2.58		Clear.	Clear.	Clear.	
25	.193	.169	.115	75.1	85.0	70.1	.776	.727	.659	.90	.61	.90	S E b E	E b S	S b W	0.37	5.76	6.29	0.579	Cir. Str. 8.	Str. 10.	Cir. Str. 2.	Thunder 12·25 p.m.
26	.264	.960	.311	57.0	73.8	60.3	.355	.489	.416	.74	.61	.79	N W b N	W N W	W	9.31	1.78	3.03		Cir. Str. 2.	Lt. Cir. 2.	Clear.	Faint Aurora.
27	.418	.433	.343	58.0	78.8	59.0	.412	.428	.426	.84	.45	.84	N N E	N E	S S W	0.27	0.53	0.93		Clear.	Cir. Str. 3.	Str. 8.	
28	.388	.400	.412	63.6	72.8	66.1	.461	.556	.489	.79	.71	.76	S W b W	S W b W	W S W	1.75	3.75	2.22		Str. 10.	Stra. 10.	Str. 10.	
29	.471	.492	.388	69.5	85.0	67.7	.541	.801	.593	.96	.68	.89	S W	S W	S b W	1.00	3.75	2.31		Clear.	Clear.	Clear.	
30	.374	.251	.229	65.0	90.7	73.0	.555	578	.692	.89	.42	.86	S S W	S W b W	S b W	2.30	1 60	2.22	0.100	Clear.	Cir. Str. 3.	Rain 7·55.	P. M. Thunder.
31	.268	.244	.272	69.0	73.0	64.2	.601	.659	.523	.85	.82	.67	N E b N	N b W	E b N	2.26	5.00	Calm.	0.040	Str. 4.	Clear.	Clear.	Faint Aurora.

Barometer.	Highest, the 7th day	29.795
	Lowest, the 25th day	29.115
	Monthly Mean	29.479
	" Range	0.680
Thermometer	Highest, the 23rd day	96°.4
	Lowest, the 2nd day	46.5
	Monthly Mean	68.04
	" Range	39.90

Greatest Intensity of the Sun's Rays—143.0.

Mean of Humidity—.727.

Lowest point of Terrestial Radiator 43.°7.

Amount of Evaporation—3.98 inches.

Most Prevalent wind—W.

Least do. do. N.

Most Windy Day—the 6th day, mean—9.56 miles per hour

Least Windy Day—18th, mean—0.06 miles per hour.

Rain fell on 9 days—amounting to 3.112 inches, and was accompanied by thunder and Lightning on three days.

Aurora Borealis visible on 7 nights.

Possible to see Aurora on 12 nights.

The electrical state of the atmosphere has been marked *generally* by Positive Electricity of a moderate intensity, and during the storm of the 4th day, indicated very high intensity of negative electricity.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—July, 1853.

Latitude 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21 *min. West. Elevation above Lake Ontario :* 108 *feet.*

Magnet.	Day.	Barom. at tem. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of the air. 6A.M.	2P.M.	10P.M.	M'N.	Tension of Vapour. 6A.M.	2P.M.	10P.M.	M'N	Humidity of Air. 6A.M.	2P.M.	10P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	M'N V	Rain in Inch.	S'n w in Inch.
						°	°	°	°												Miles		
a	1	29.628	29 635	29.656	29.643	64 3	71.2	60.0	66.08	0 516	0.522	0.420	0.501	88	71	83	80	N b W	S b W	N N W	4.33	- -	- -
a	2	.725	.693	.603	.668	58 2	68.6	63.2	65.07	.392	.363	.412	.391	83	53	73	66	N b E	E b N	E N E	6.16	0 020	- -
a	3	.508	.491			63 9	74.7			.536	.649			93	78			Calm	E		2.74	0.050	-
a	4	.501	.436	.516	.484	68.2	82.9	64 6	72 67	.573	.375	.514	.483	86	34	87	66	Calm	W b S	N N W	6.28	0.020	-
b	5	.491	.467	.588	.521	61.3	76 2	60.3	65 33	.450	.357	.402	.411	85	57	79	72	Calm	W N W	N W	6.43	- -	- -
b	6	.647	.710	.760	.711	56.4	73.6	58.5	63.55	.405	.333	.304	.329	92	41	64	61	Calm	N b W	Calm	3.10	- -	- -
b	7	.826	.810	.725	.780	55.9	74.9	59.8	65.00	.368	.424	.403	.395	84	51	80	68	Calm	S S E	S S W	1.89	0.055	- -
b	8	.655	.647	.644	.646	62.9	74.9	62 5	66.67	.469	.594	.394	.486	83	71	72	76	Calm	S b W	Calm	2.37	- -	- -
c	9	.615	.619	.616	.616	63·2	73.3	64.8	66.12	.508	.510	.420	.470	90	65	71	77	Calm	S W b W	S S W	2.07	- -	-
d	10	.663	.623			59 5	76.4			.445	.492			89	56			Calm	S		2.23	- -	-
b	11	.685	.701	.746	.716	58.9	72.7	58.6	64 40	.307	.423	.303	.347	63	54	63	59	Calm	S b E	N b W	3 30	- -	- -
e	12	.802	.807	.814	.812	56.0	71.4	60.7	63.10	.323	.458	.468	.406	74	61	90	73	N	S E b S	Calm	3.83	- -	- -
	13	.889	.865	.839	.865	56.4	74.1	54.7	63.22	.348	.433	.345	.379	78	53	82	68	N b E	S S E	S S E	4.21	- -	- -
b	14	.777	.693	.588	.675	56.1	72.8	65.8	66.80	.346	.375	.490	.440	79	47	79	69	N E	E	Calm	2 62	0.025	- -
c	15	.473	.297	.373	.369	63.9	69 6	61 3	66.40	.520	.593	.505	.549	90	84	95	87	Calm	S	Calm	4.27	0.480	- -
c	16	.383	.499	.585	.499	60.4	60 0	57.1	59.20	.439	.320	.367	.361	86	63	80	74	N W	N N W	N N W	7.99	- -	-
c	17	.635	.646			50.6	67.9			.309	.404			85	61			N N W	S b E		4.55	- -	- -
b	18	.705	.729	.731	.720	53.3	65.3	54.2	58 93	.366	.443	.371	.403	86	73	90	83	N b E	E	Calm	1.97	- -	- -
a	19	.777	.740	.775	.764	54.8	74.8	57.9	61.85	.329	.485	.369	.390	78	53	79	71	Calm	S E b S	W b S	4.12	Inap	- -
	20	.787	.719	.706	.732	56.1	77.1	64.9	67.13	.357	.461	.316	.380	81	51	53	60	N	S b W	N b W	4 66	- -	- -
	21	.692	.650	.664	.671	61.3	78.7	62 2	69 23	.437	.446	.347	.437	83	48	63	64	N b W	S S E	S	3.07	- -	- -
c	22	.688	.643	.601	.641	56.2	83.1	62.9	69.27	.336	.303	.455	.388	76	28	82	61	S	S E b S	Calm	2 16	- -	- -
c	23	.613	.562	.559	.572	56.4	82.9	65.2	70.72	.334	.433	.433	.448	75	40	73	64	Calm	S E b S	Calm	0 63	- -	- -
b	24	.583	.532			59.2	85.4			.376	.531			78	45			Calm	S E b S		2.63	0.080	- -
b	25	.331	.342	.470	.399	69 5	77.2	60.7	68.62	.582	.684	.385	.554	84	75	75	79	S S E	S b W	N N W	7 96	Inap	- -
c	26	.598	.633	.677	.638	54.9	68.1	52 5	58.57	.326	.366	.307	.32	77	54	80	69	N b E	S b E	Calm	4.25	- -	- -
c	27	.687	.673	.694	.685	49.4	76 5	61.5	64·80	.206	.406	.445	.364	59	46	83	61	S b E	S E b S	S b E	3.78	- -	- -
c	28	.737	.761	.791	.769	55.6	73.6	61 1	64.15	.478	.553	.424	.475	87	69	81	79	Calm	S	Calm	4 06	- -	- -
b	29	.825	.768	.722	.769	53.1	80.4	64 2	67.52	.335	.504	·462	.453	85	50	79	70	S S W	S E	E N E	3 16	- -	- -
b	30	.708	.664	.662	.678	63.2	80.4	65.7	71.20	.391	.531	·392	.46	70	53	64	64	Calm	S b E	Calm	1.75	- -	- -
b	31	.686	.670			65 3	80 3			.491	.644			81	64			N	S E b S		2 14	0.180	- -
	M	29 663	29.645	29.658	29.655	58 77	74 40	60 96	65.60	0 401	0.450	0.402	0.425	81	56	77	70	Ml's 1.62	Ml's 7 44	Ml's 2 07	3.70	9.15	- -

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1013.05	546.77	1068.57	768.43

Mean direction of the wind E. by S.
Mean velocity of the wind - - - 3.70 miles per hour.
Maximum velocity - - - - - - 17 3 miles per hour, from 2 to 3 p.m. on 5th.
Most windy day - - - - - 16th: Mean velocity, 7.99 miles per hour.
Least windy day - - - - - 23rd: Mean velocity, 0.63 ditto.
Raining 12.7 hours.

The column headed "Magnet" is an attempt to distinguish the character of each day, as regards the frequency or extent of the fluctuations of the Magnetic declination, indicated by the self-registering instruments at Toronto. The classification is, to some extent, arbitrary, and may require future modification, but has been found tolerably definite as far as applied. It is as follows:—

(*a*) A marked absence of Magnetical disturbance.
(*b*) Unimportant movements, not to be called disturbance.
(*c*) Marked disturbance—whether shewn by frequency or amount of deviation from the normal curve—but of no great importance.
(*d*) A greater degree of disturbance—but not of long continuance.
(*e*) Considerable disturbance—lasting more or less the whole day.
(*f*) A Magnetical disturbance of the first class.

The day is reckoned from noon to noon. If two letters are placed, the first applies to the earlier, the latter to the later part of the trace. Although the Declination is particularly referred to, it rarely happens that the same terms are not applicable to the changes of the Horizontal Force also.

Highest Barometer - - 29 906, at 8 A.M., on 13th. } Monthly range:
Lowest Barometer - - 29.274, at 4 P.M., on 15th. } 0.632 inches.
Highest regist'd Temp. - 91 3, at — P.M., on 24th } Monthly range:
Lowest regist'd Temp. - 41.6, at — A.M., on 27th } 49.7
Mean Maximum Temperature - - - - 77 02 } Mean daily range:
Mean Minimum Thermometer - - - - - 53 22 } 23.80
Greatest daily range - - - - -30.7 from P.M. of 4th, to A.M. of 5th.
Warmest day - - 4th - - - Mean Temperature - 72.67 } Difference
Coldest day - - - 26th - - - Mean Temperature - 58 57 } 14.10

The "Means" are derived from six observations daily, viz., at 6 and 8 A. M., and 2, 4, 10 and 12, P. M.

Possible to see Aurora on 25 nights.
Impossible to see Aurora on 6 nights.
Aurora actually observed on 6 nights.
Brilliant display of Aurora on 12th.

Comparative Table for July.

Year.	Temperature. Mean.	Max. obs'rvd	Min. obs'rvd	Range.	Rain. D'ys	Inches.	Snow. Dy's	Inch.	Wind Mean Velocity.
	°	°	°	°					Miles.
1840	66.0	79.4	48.2	31 2	6	5.270	0	--	--
1841	65.0	86.3	43.2	43.1	10	8.150	0	--	--
1842	64 7	90 5	42.0	48 5	4	3.050	0	--	--
1843	64 5	86.1	40.2	45 9	8	4 605	0	--	0.44 lb
1844	66.0	86.1	40.5	45.6	12	2 815	0	--	0 19
1845	66 2	94.6	45.6	49.0	7	2.195	0	--	0.30
1846	68.0	94.0	44 9	49 1	9	2 895	0	--	0.29
1847	68.0	87.5	43 8	43.7	8	3 355	0	--	0 19
1848	65.5	82.7	46.7	36.0	10	1.890	0	--	4 94 m
1849	68 4	89 1	51.0	38 1	4	3 415	0	--	3 52
1850	68.9	84 9	52.8	32.1	12	5.270	0	--	4 56
1851	65 0	82.7	52 1	30 6	12	3 625	0	--	4 13
1852	66 8	90.1	49 5	40 6	8	4 025	0	--	3 33
1853	65.6	85 4	49 4	36 0	10	0.915	0	--	3.70
Mean	66.33	87.10	46.42	40 68	8 6	3.677	0		4.03

This month may be considered the dryest that has ever been known for the whole 13 years, the whole fall of rain not amounting to one inch, and the number of hours during which it fell being only 12·7: the mean temperature of the month is 0°.7 below the average of the same number of years, but the march of the temperature has been tolerably steady, a series of 4 cold days occuring from 16th to 19th.

A heavy storm occurred on the 15th, accompanied with violent discharge of hail, westward of Toronto: an observer at Weston states that "five per cent of the hailstones were as large as pullets' eggs, and generally they were as large as cherries;" the outline of sone of the largest, of a quadrangular shape, measured 2½ by 2 inches.

Gold Testing.—The gold dust buyers of Southampton use an immense magnet as one means of testing the purity of the gold. By plunging this magnet into a heap of gold dust the freedom of the latter from metalliferous admixture or otherwise is discovered by the quantity and degree of firmness with which the dust adheres to the magnet. It is this test which detects the superior purity of Australian, as compared with Californian gold.

The Canadian Journal.

TORONTO, SEPTEMBER, 1853.

Variations in the Level of the Lakes.

The recent extraordinary rise in the waters of the Great Lakes has assumed an importance in relation to navigation, boundaries of property, and the preservation of property situated upon their shores, which throws into the shade all considerations of the phenomenon as a purely scientific question. It will be interesting to enquire whether the present remarkable rise is due to causes which do not at present appear, or whether it is the result of extraordinary rainfall, followed by an unusually small degree of evaporation. Other phenomena of a less general description, yet also influencing the level of the Lakes in different localities, demand attention. We think that the fluctuations in the water level of our inland seas may be conveniently divided into three groups:—

1. Variations in the general level of the waters of the Lakes.
2. Sudden local variations.
3. Influx and efflux of the mouths of rivers and harbours.

We propose to enumerate some of the changes which have been observed in the levels of Lakes Erie and Ontario before proceeding to enquire into the causes which have occasioned them. It is well known that these changes have produced very remarkable effects upon the coast wherever the drift clays or the softer shales form the lake boundaries, and even where the coast is in the form of a sloping beach.

We glean the following notices from Hall's Geology of the 4th District of New York:—

"Twenty-five and thirty years ago the beach of Lake Erie was a travelled highway beyond Buffalo, but at this time it would be quite impossible to travel along the same."

"From the united testimony of persons residing along the margins of all the Lakes, and from other demonstrative proofs, it appears that for many years previous to 1838, all the Lakes had been rising; that about this period they attained their maximum, and have since been subsiding."

"Mr. Hiram Burton, who resided at the mouth of Slippery-Rock Creek for twenty-three years, informed me (Mr. Hall,) in 1840 that the water of Lake Erie was then four feet higher than when he came to that place; that in 1838 it was still higher, but he had made no accurate measurements."

"Mr. Higgins, Topographer to the Geological Survey of Michigan, has given the rise of the Lakes as five feet three inches from 1819 to 1838; he regards it as probable that the minimum period continues for a considerable length of time, while the maximum continues only for a single year."

Several of the Lake shore or beach roads on the North side of Lake Ontario have disappeared in numerous localities, within the memory of living residents. The old Lake Shore Road, from Toronto to Hamilton, is in parts quite washed away, and we were informed by a resident, a mile or so to the west of the Humber, that a road existed about seven years ago below the present old road. The shore is flat at the place just alluded to, and the destruction of the first and second roads may be attributed to the effects of South-Easterly winds upon a high level of the waters of the Lake. A storm from the South East would place the new Plank Road in considerable jeopardy. A very favourable illustration of some of the results to be anticipated by high lake levels in conjunction with prolonged storms, exists now at the Peninsula opposite the Toronto City Hall, where a wide gap was formed during the Spring of the present year by the waves of the Lake washing away sand, shingle and pebbles to the depth of several feet. The Canal thus formed is at present about 160 feet wide and 4 feet deep. Its width and depth, and even its position are constantly varying with each high wind from the East, South or South West. Similar occurrences have been frequently observed to take place in the narrow stripe between Ashbridge's Bay and the Lake on the same Peninsula; and at the present moment, and about the same place, a sand and gravel ridge not less than three feet above the present high level of the Lake, is to be found occupying the spot where open communications existed between the Bay and the Lake during a part of last winter and the winter of 1849. We may learn from these occurrences the probable fate of the Canal opposite the City Hall. The effects of high lake levels upon the precipitous clay cliffs which form a very large portion of the coast lines of Lakes Erie and Ontario, are interesting both in their relation to property and to the future probable condition of the Lakes, as well as to their past history. An average of a yard a year would be a very moderate allowance for the encroachments of the waters upon the land, occasioned by the washing away of the cliffs which form the coast. We have lately witnessed the entire removal of many acres of land, on which large trees were growing, by the encroachment of the waters of Lake Simcoe on its eastern shores. Instances might be multiplied to shew that the annual march of the waters *inland* is a very curious item in the physical history of the Great Lakes, and one to which we are inclined to ascribe far greater importance in many relations than appears at the first view of this phenomenon.

We now proceed to give such results as we have been able to collect from the different observers who have interested themselves in the rise and fall of the waters of the Great Lakes. The following table shows the mean depth, the least depth, the greatest depth, the monthly fluctuation, and the greatest fluctuation during twenty-four hours, which we have reduced from the measurements made at Port Colborne, Welland Canal, Lake Erie, during the years 1850, 1851 and 1852. The influence of winds, and probably of local variations in the atmospheric pressure, will become apparent upon examination of the column which gives the greatest fluctuations during twenty-four hours.

TABLE *of the Variations in the Level of Lake Erie, at Port Colborne, during the years* 1850, 1851, *and* 1852:

MONTH.	Mean Depth.	Least Depth.	Greatest Depth.	Monthly Fluctuation.	Greatest Fluctuation in 24 hours.
	feet.	feet.	feet.	feet.	feet.
1850—April	12.25	11.5	12.83	1.33	0.91
May	12.32	11.83	12.83	1.00	0.56
June	12.05	11.75	12.50	0.75	0.50
July	12.16	11.75	12.83	1.08	0.75
August	11.98	11.25	12.75	1.50	0.91
September	11.82	10.66	12.41	1.75	1.33
October	11.74	11.08	13.16	2.08	1.87
November	11.45	10.75	12.33	1.58	0.75
December	11.70	9.83	14.83	5.00	4.33
1851—January	12.12	11.08	15.16	4.08	4.00
February	11.85	9.79	12.16	2.37	1.41
March	12.28	11.33	13.16	1.83	0.83
April	12.3	10.8	13.4	2.6	2.25
May	12.9	12.1	16.4	4.3	3.9
June	13.18	12.58	13.84	1.26	.75
July	13.23	12.5	14.25	1.75	1.35
August	13.	12.08	13.5	1.42	1.17
September	12.57	11.17	14.25	3.08	1.75
October	12.73	12.08	14.03	2.00	1.6
November	12.6	11.17	14.25	3.08	1.75
December	12.74	11.83	14.6	2.77	1.66
1852—January	12.2	9.75	13.92	4.37	1.5
February	11.8	10.9	12.5	1.6	1.08
March	12.1	11.17	13.66	2.49	1.66
April	12.8	9.83	14.16	4.33	3.16
May	13.6	13.00	16.33	3.33	2.5
June	13.8	12.9	15.00	2.3	1.08
July	13.5	12.16	14.9	2.73	2.75
August	13.35	13.3	13.5	.5	.5

The lowest monthly mean depth of the waters of Lake Erie, on the sill of the lock at Port Colborne, during the interval between April, 1850, and August, 1852, a period of 32 months, appears to have been 11.45 feet, which occurred in November, 1850. The highest observed mean was in July, 1852, when the depth appears to have been 13.55 feet, giving a difference of 2.1 feet.

The least depth recorded occurred in January, 1852—9.75 feet; the greatest depth in May 1851, and in May 1852, when the height of the water was indicated by 16.33 feet, affording a difference of 6½ feet, which was due, without question, to the prevalence of westerly winds. To the same influence we may ascribe the remarkable monthly fluctuations, and to a great extent, the fluctuations during twenty-four hours. The greatest monthly fluctuation recorded is 5 feet; the greatest daily fluctuation is 4⅓ feet. It is a matter of some uncertainty whether the daily fluctuations are due to the influences of winds alone; it appears probable that local variations in atmospheric pressure may have something to do with this phenomenon. The situation of Port Colborne, at one extremity of Lake Erie, is most favourable for the influence of westerly winds, whose effects upon the coast of Buffalo and other neighbouring localities are well known. The westerly winds are among the most frequent and powerful which affect Lake Erie, and they occasionally produce very disastrous results at the eastern extremity of the Lake.

The levels of Lake Ontario, at Port Dalhousie, are given below, for the years 1851 and 1852; they do not indicate the extraordinary fluctuations which distinguish the water-levels of Lake Erie. The sheltered situation of Port Dalhousie sufficiently explains this difference.

TABLE *of the Variations in the Level of Lake Ontario, at Port Dalhousie, during the years* 1851 *and* 1852:

MONTH.	Mean Depth.		Least Depth.		Greatest Depth.		Greatest Monthly Fluctuation.		Greatest Fluctuation in 24 hours.	
1851.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
January	11	8	11	8	11	9	0	1	0	1
February	11	10	11	9	12	0	0	3	0	1
March	12	5	12	1	12	7	0	6	0	2
April	12	10	12	7	13	2	0	7	0	2
May	13	3	13	2	13	3	0	1	0	1
June	13	4	13	3	13	5	0	2	0	0
July	13	2	13	1	13	4	0	3	0	1
August	---	---	---	---	---	---	---	---	---	---
September	12	10	12	8	13	0	0	4	0	1
October	12	5	12	3	12	7	0	4	0	1
November	12	3	12	3	12	4	0	1	0	1
December	12	2	12	2	12	3	0	1	0	1
Mean yearly difference.	1	8	---	---	---	---	---	---	---	---
1852.										
January	12	2	12	2	12	2	---	---	---	---
February	12	2½	12	1	12	4	0	3	0	1
March	12	7	12	4	12	9	0	5	0	1
April	13	1	12	10	13	6	0	8	0	2
May	14	3½	13	6	14	4	0	10	0	2
June	14	6½	14	4	14	7	0	3	0	1
July	14	5	14	4	14	6	0	2	0	1
Mean yearly difference.	2	3½	---	---	---	---	---	---	---	---

The Lock-Master (Mr. Geo. Thompson) at the Burlington Bay Canal, in his Report to the Secretary of the Board of Works on the subject of the rise and fall of the Lakes, remarks:—

"As far back as 1836 we had exactly the same high water as we have had this season. I do not remember, in the interval of 16 years, of ever the water being so high; the mean of the rise of each year in that interval may, I think, be stated pretty correctly at from 22 to 28 inches; this season it has risen to 3 feet. 6½ inches above the low water mark that I took in 1848. It had not been as low for several years, and has not been as low since, but it must be remembered that it did not fall to that mark last winter by 6 inches; deducting that from 3 ft. 6½ inches, we have a dead rise of 36½ inches for this season. In March of this year the water was very near up to its old standard, which was rather singular; it rose rapidly until about the middle of May; curiosity induced me to measure it, when I found it 3 feet above the low water mark of 1848. I kept measuring it at intervals as follows:—

May 26th, 3 feet 2 inches above the low water mark of '48.
June 8th, 3 " 3½ " " " "
" 15th, 3 " 4 " " " "
" 21st, 3 " 6 " " " "
" 25th. 3 " 6½ " " " "

It stood at this until the beginning of August. On the 4th it had fallen 2 inches; on the 15th 6 inches. September 1st, it

had fallen 12 inches; 9th, it had fallen 4 inches; on the 22nd, 9 inches; 12th, 14 inches. It will continue falling till November, and sometimes well on in December; it will then remain stationary till a short time before the breaking up of the ice."

In answer to an enquiry we made some short time since of Mr. Geo. Thompson respecting the height of the Lakes this year, we were informed—

"That the water here on the 7th June, was 8 inches higher than in 1852, making it full 4 feet 2 inches higher than in 1848. It began to fall on the 13th of June; on the 19th it had fallen 2½ inches; on the 11th July 5 inches; on the 21st 6 inches; on the 29th 7½ inches; on the 4th August 9 inches; and to-day 10½ inches nearly;—it is, consequently, about 2½ inches below. the years 1836 and 1852—at present. Its usual time for commencing to fall is from the 1st to the 10th July, whereas it had fallen 1 inch on the 13th June."

Observations made at the Queen's Wharf, Toronto, under the direction of CAPTAIN LEFROY, R.A.

1849.					1852.				
March	14th,	1	0		May	10th,	9	4½	
"	24th,	1	1½		"	15th,	3	5½	
"	26th,	1	3		"	18th,	3	7	
"	"	1	4		"	20th,	3	7½	
April	4th,	1	6		"	29th,	3	8	
"	9th,	1	8		June	3rd,	3	8	
"	10th,	1	10		"	7th,	3	7	
"	30th,	1	11		"	12th,	3	11	
May	2nd,	1	11		"	14th,	4	0½	
"	6th,	2	3		"	29th,	3	11	
"	7th,	2	1		"	30th,	4	1	Highest.
"	14th,	1	11		July	5th,	3	11	
"	21st,	2	2		"	13th,	4	0	
"	"	2	4		"	21st,	3	10	
July	3rd,	2	5		Aug.	19th,	3	5	
August	5th,	1	11		Sept.	6th,	3	2	
"	15th,	1	8		"	30th,	2	10	
Sept.	20th,	1	6		Nov.	18th,	2	6	
Oct.	25th,	0	3	Lowest.	"	24th,	2	7	
Nov.	31st,	1	9		Dec.	17th,	2	9	Wind.
Dec.	20th,	1	1						

These have always been taken on calm days, with one or two exceptions.

Mr. Dade recorded that, on July 1st, 1836, the water in perfect calm stood within 3 feet of the top of the Queen's Wharf. If so, it stood eight inches higher than it did on June 30, 1852, and about the same height as in June 1st, 1853.

Observations made at Gorrie's Wharf by MR. G. A. STEWART.

MONTH OF JUNE.				MONTH OF JULY.				MONTH OF AUGUST			
Day.	Hour.	Height of Water.	Direction of Wind.	Day.	Hour.	Height of Water.	Direction of Wind.	Day.	Hour.	Height of Water.	Direction of Wind.
1	9½ A. M.	4.73	E	2	3 P. M	4.50	E	1	4 P. M.	3.99	E
"	2 P. M.	4.72	E	4	9½ A. M.	4.50	S W	2	12 noon.	4 00	
2	9 A. M.	4.68	E	5	10 A. M.	4.46	S W	3	5 P. M.	4.00	E
"	4½ P. M.	4.68	E	6	9½ A. M.	4.37	S W	5	12 noon.	3.95	
3	9½ A. M.	4.68	S W	7	12 noon.	4.40	S	7	4 P. M.	3.96	
4	10 A. M.	4.64	S E	16	12 noon.	4.15	S	8	4 P. M.	3.93	
6	9½ A. M.	4.68	S E	18	11 A. M.	4.25	S	10	4 P. M.	3.90	
7	9½ A. M.	4.60	W	20	12½ P. M.	4.17	W	12	12 noon.	3.86	
11	9½ A. M.	4.66	E	23	10 A. M.	4.[illegible]3	S W	15	12 noon.	3.85	S E
16	11 A. M.	4.70	Calm.	27	12 noon.	4.05	S	16	12 noon.	3.81	S E
17	10½ A. M.	4.62	S W	30	11 A. M.	4.00	S E	18	11 A. M.	3 80	
20	9¼ A. M.	4.59	S W					20	4 P. M.	3.82	
23	9¾ A. M.	4.60	S W					23	10 A. M	3.60	
24	12 noon.	4.55	W					25	9 A. M.	3 60	
25	9½ A. M.	4.43	N W					27	12 noon.	3.60	
28	9½ A. M.	4.50	E					29	12 noon.	3.40	
30	9 A. M.	4.54	S W					31	22 P. M.	3.40	

These observations are taken from a scale established at Gorrie's Wharf. The zero of which scale is left below the sill of the South West door of the Custom House, and corresponds with the scale on the Queen's Wharf, established by Capt. Lefroy.

We reserve for the next number of the Journal other data connected with the variations of the level of the lakes, as well as the discussion of the inferences which may be drawn from them. Meanwhile, we call attention to the following interesting paper, by Colonel Jackson, which has been widely circulated in manuscript, (in 1847,) but which has not yet, as far as we are aware, appeared in any accessible publication. It is addressed to the Royal Geographical Society.

On the Seiches of Lakes, by Col. J. R. Jackson, F. R. G. S., St. Petersburgh.

The Lake Leman, or of Geneva, has been long remarkable for a phenomenon known by the name of *Seiches*, and which has been considered peculiar to this lake: it consists of a kind of ebb and flow of the waters of the lake, in certain parts, without wind or any other apparent cause. While the phenomenon lasts, the waters are seen to rise and fall several times in the course of a few hours. These oscillations, more or less considerable, sometimes attain the height of 5 feet, though the general maximum seldom exceeds 2 feet: in the greater number of cases, the rise is confined to a few inches, the minimum being 0.

The *Seiches* of the Lake of Geneva, were observed in the beginning of the last century, by Fatio de Duilliers, who has given a description of them in a Memoire inserted in the 2nd volume of Spon's "Histoire de Geneve." Shortly after Professor Jallabert made mention of them in the "Memoires de l'Academie des Sciences." And more lately Mr. Serre in the "Journal des Savans;" Professor Bertrand, in an academical dissertation, not printed; as also de Saussure in the 1st Volume of his "Voyage aux Alps," have successively described this singular phenomenon.

Nothing, however, having been explained in a satisfactory manner, I wrote, some months since, to a learned Professor of Geneva, on the subject, proposing questions, the answers to which I hoped might throw some light on the nature of a fact which I apprehended to ~~be~~ by no means peculiar to the lake of Geneva, and I have reason to congratulate myself that the result of this step has been the publication of an able and detailed memoir on the subject by Professor Vaucher, which memoir had been written many years before, and which, in all probability, would never have been printed, but at the instigation of Professor Maurice, to whom I had written, and who, with that readiness which distinguishes the real lover of science, interested himself immediately in the subject.

From Professor Vaucher's memoir, a 4-to of 60 pages, written in French, so far back as the years 1803-4 it appears:—

1stly, That the Seiches of the Lake of Geneva are much more frequent than is generally imagined.

2ndly, That they happen at all seasons of the year and at all hours of the day; but that they are, generally speaking, most frequent in the Spring and in the Autumn.

3rdly, That the state of the atmosphere seems to have a decided influence, it being remarked, that in proportion as that state is less changeable, so are the Seiches less frequent, and *vice versa.* The Seiches have always been "*considerable*" (query as to frequency or magnitude?) when the atmosphere has been loaded with heavy clouds, or when the weather, in other respects severe, has threatened to be stormy, and when the barometer has sunk.

4thly, That although the seiches are more frequent in the Spring

and in the Autumn, they are, however, more "*considerable*" (rise higher) in the summer, and in particular towards the close of that season. The highest that have been observed happened in the month of September.

5thly, The minimum of the Seiches has no precise term, their maximum seems to be 5 feet.

6thly, That although the duration of the Seiches is very variable, its greatest extent seems not to exceed 20 or 25 minutes, but usually lasts a much shorter time.

7thly, That the Seiches are not peculiar to the Lake of Geneva, Mr. Vaucher having observed them on the Lakes of Zurich, of Annecy and of Constance.

It appears unquestionable that the phenomenon of the Seiches is due to an unequal pressure of the atmosphere on different parts of the Lake at the same time, that is, to the simultaneous effect of columns of air of different weight or different elasticity, arising from temporary variations of temperature or from mechanical causes; and if such be in fact the case, all lakes of a certain extent, and even inland seas, must be subject to the same influence, and therefore present the same phenomenon; and I have little doubt but that correct observations will verify this presumption.

Moreover, the effect of unequal atmospheric pressure, in producing inequality in the level of the surface of large masses of water, once established as a positive fact, will throw much light upon several subjects interesting to physical geography, particularly upon that of currents, as affected by sea and land breezes, irregular winds, sudden changes of temperature, the configuration and aspect of coasts as regards the Sun, and the consequent periodical influence of reverberated heat on the density of the circumjacent air. It is, therefore, upon these considerations that I am desirous of calling to the subject the attention of such persons, as from the habitual nature of their occupations, or their studies, or their love of science, are best enabled to add to our knowledge regarding it; and in the hopes that some of the members of our Society, or that, at their instigation, others who may be in the vicinity of lakes in any part of the world, will take up the subject, I shall venture to offer what I conceive to be the best method of operating.

1st, **Several points must be chosen on the lake**, some in its narrower and some in its wider parts, as well as at the mouth of its most considerable *affluent*, and at the immediate egress of its main outlet. If the surface of the lake be observed to incline towards the outlet from any distance, a station should be established at the commencement of this slope, as well as at the immediate egress.

2ndly, These points once chosen, a squared pole must be driven, having marked upon it, in white upon a black, or in black upon a white ground, feet, inches, and lines, for at least five feet above and as many below, the general water level. To this pole must be added a float, surrounded by a rod to act as an indicator, which rod must slide easily in brackets fastened to the pole. Round the pole and rising above the water, an inclosure of about 2 or 3 feet diameter must be established of hurdles or planks, in such wise, that while the water within has free communication with that which is without the enclosures, so as to rise and fall with it, the former may be kept calm and secured from all influence of winds and waves.

3rdly, These stations being established, two observers at least, and more if possible, must commence their observations at an hour agreed upon, having first compared their watches. If *each* observer could at the same time be furnished with a barometer, thermometer, and hygrometer, the general results of their observations would be so much the more satisfactory; but one instrument of each kind is indispensable. In the former case, each observer will note the indications of his own instrument.

4thly, Care must therefore be taken to note down at the beginning, during, and at the close of the observations, the indications of the several instruments, together with the general state of the weather and the direction of the wind, if there be any, though it is most advisable to observe before and after wind.

5thly, The change of level of the water must be noted sometimes every minute; at others every ten minutes—every half hour —or every hour. The observations should be sometimes made at sunrise, three hours after his ascension, at noon, at 3 in the afternoon and at sunset, as also after, if convenient, in order to see how far the hour exercises an influence on the phenomenon. It would likewise be well to observe if the moon has any influence, and, for this purpose, observations should be made at the new and full moons and at the quadratures.

6thly, On an outline sketch plan of the lake must be marked the different stations, numbered or lettered, indicating the distance of each station from each other. This is necessary in order that the observer may be assured whether the rise or fall observed simultaneously at two or more stations are distinct and independent, though simultaneous effects, or dependent and corresponding oscillations.

7thly, For each series of observation, a table, in the following form, should be arranged:

OBSERVATIONS *on the Seiches of Lake* ______________

made by ______________________ Date. ______________

TIME OF DAY.		STATION A.	STATION B.	&c	REMARKS.
HOUR.	MIN.				
9	0	r or f.* ft in li.	r. or f. ft. in li.		
	10				
	20				
	&c.				

Moreover, in order that nothing may be omitted which can be supposed to exercise any influence, the topographical structure of the basin, and particularly the aspect, height, condition, and nature of the hills in the immediate vicinity of the lake, if there be any; or, otherwise, their absence must be carefully noted.

It were needless to add, that the more numerous the observations, the better; and the more that may be made simultaneously, the more satisfactory will be the result.

I will not presume so far to question the sagacity of the Society, as to enumerate all the advantages that are likely to accrue from observations of the kind just stated, they will be, I doubt not, as evident to all, as they are to myself, and it is from this conviction, that I venture to call the attention of my colleagues to the subject.

Schutter, as may be seen in the "Memoirs de l'Academie des Sciences de Stockholm" for 1804, explains the irregular rise and fall of the Baltic on the same principle as de Saussure and Vaucher explain the Seiches of the lake of Geneva. I hope to be one day enabled to add further observations in support of the general prevalence of the phenomenon.

I have lately written to a most eminent philosopher, the

* R. or F. for *rise* or *fall*, as it may be. All that is required is *relative* rise and fall, the height at which the water may be found on commencing the operation will always be 0. In the column of remarks will be consigned the indications of the barometer, &c.

present boast of Sweden, begging of him to institute observations (similar to those here proposed) upon the great lakes of his country; I have also written to the United States, on the same, and circulars have been addressed, officially, to the Engineer Officers stationed at the several great lakes of Russia, as far as the Baikal, for the same purpose. If, as I trust, we shall by these means obtain a mass of well-authenticated information, we shall have one fact more to add to our knowledge of the earth, and one fact often leads to many. I sincerely hope the Royal Geographical Society will not consider the subject unworthy their notice.

To the above I may add that self-registering indicators would be very desirable, because the phenomenon is one which happens only occasionally, and that suddenly, giving no previous warning. These indicators would show what had taken place in the absence of the observer, and if, after a time, the phenomenon was observed to be more frequent than is supposed, or to happen at stated times, then the observers might, so to say, lie in wait for them, and notice all the facts of the case.

T. JACKSON.

The Narcotics we Indulge In.*

In ministering fully to his natural wants, man passes through three successive stages. First, the necessities of his material existence are provided for; next, his cares are assuaged and for the time banished; and lastly, his employments, intellectual and animal, are multiplied, and for the time exalted. Beef and bread represent the means by which, in every country, the first end is attained; fermented liquors help us to the second; and the third we reach by the aid of narcotics.

When we examine, in a chemical sense, the animal and vegetable productions which in a thousand varied forms, among various nations, take the place of the beef and pudding of the Englishman in supplying the first necessities of our nature, we are struck with the remarkable general similarity which prevails among them naturally, or which they are made to assume by the artifices of cookery, before they are conveyed into the stomach. And we exclaim, in irrepressible wonder, "by what universal instinct is it that under so many varied conditions of climate and of natural vegetation, the experience of man has led him everywhere so nicely to adjust the chemical constitution of the staple forms of his diet to the chemical wants of his living body?" Nor is the lightening of care less widely and extensively attained. Savage and civilised tribes, near and remote—the houseless barbarian wanderer, the settled peasant, and the skilled citizen—all have found, without intercommunion, through some common and instinctive process, the art of preparing fermented drinks, and of procuring for themselves the enjoyments and miseries of intoxication. The juice of the cocoa-nut tree yields its *toddy* wherever this valuable palm can be made to grow. Another palm affords a fermented wine on the Andean slopes of Chili—the sugar palm intoxicates in the Indian Archipelago, and among the Moluccas and Phillippines—while the best palm wine of all is prepared from the sap of the oil-palms of the African coast. In Mexico the American aloe *(Agave Americana,)* gave its much-loved *pulque*, and probably also its ardent brandy, long before Cortez invaded the ancient monarchy of the Aztecs. Fruits supply the cider, the perry, and the wine, of many civilized regions—barley and the cereal grains the beer and brandy of others; while the milk of their breeding mares supplies at will to the wandering Tartar, either a mild exhilarating drink, or an ardently intoxicating spirit. And to our wonder at the wide prevalence of this taste, and our surprise at the success with which, in so many different ways, mankind has been able to gratify it, the chemist adds a new wonder and surprise when he tells us, that, as in the case of his food, so in preparing his intoxicating drinks, man has everywhere come to the same result. His fermented liquors, wherever and from whatever substances prepared, all contain the same exciting alcohol, producing everywhere upon every human being, the same exhilerating effects!

It is somewhat different as regards the next stage of human wants—the exalted stage which we arrive at by the aid of narcotics. Of these narcotics it is remarkable that almost every country or tribe has its own—either aboriginal or imported—so that the universal instinct has led somehow or other to the universal supply of this want also.

The aborigines of Central America rolled up the Tobacco leaf, and dreamed away their lives in smoky reveries, ages before Columbus was born, or the colonists of Sir Walter Raleigh brought it within the chaste precincts of the Elizabethan court. The cocoa leaf, now the comfort and strength of the Peruvian muletero, was chewed as *he* does it, in far remote times, and among the same mountains, by the Indian natives whose blood he inherits. The use of opium and hemp, and the betel nut, among eastern Asiatics, mounts up to the times of most fabulous antiquity, as probably does that of the pepper tribe in the South Sea Islands and the Indian Archipelago; while in northern Europe the hop, and in Tartary the narcotic fungus, have been in use from time immemorial. In all these countries the wished for end has been attained, as in the case of intoxicating drinks, by different means; but the precise effect upon the system, by the use of each substance, has not, in this case been the same. On the contrary, tobacco, and cocoa, and opium, and hemp, and the hop, and *Cocculus indicus*, and the toadstool, each exercises an influence upon the human frame, which is peculiar to itself, and which in many respects is full of interest, and deserving of profound study. These differences we so far know to arise from the active substance they severally contain being chemically different.

I. Tobacco.—Of all the narcotics we have mentioned, tobacco is in use over the largest area, and by the greatest number of people. Opium comes next to it; and the hemp plant occupies the third place.

The tobacco plant is indigenous to tropical America, whence it was introduced into Spain and France in the beginning of the sixteenth century by the Spaniards, and into England half a century later (1586) by Sir Francis Drake. Since that time, both the use and the cultivation of the plant have spread over a large portion of the globe. Besides the different parts of America, including Canada, New Brunswick, the United States, Mexico, the Western coast, the Spanish main, Brazil, Cuba, St. Domingo, Trinidad, &c., it has spread in the East into Turkey, Persia, India, China, Australia, the Phillipine Islands, and Japan. It has been raised with success also in nearly every country of Europe; while in Africa it is cultivated in Egypt, Algeria, in the Canaries, on the Western coast, and at the Cape of Good Hope. It is, indeed, among narcotics, what the potato is among food-plants—the most extensively cultivated, the most hardy, and the most tolerant of changes in temperature, altitude, and general climate.

We need scarcely remark, that the use of the plant has become not less universal than its cultivation In America it is met with everywhere, and the consumption is enormous. In Europe, from the plains of sunny Castile to the frozen Archangel, the pipe and the cigar are a common solace among all ranks and conditions. In vain was the use of it prohibited in Russia, and the knout threatened for the first offence, and death for the second. In vain Pope Urban VIII. thundered out his bull against it. In vain our own James I. wrote his "Counterblaste to Tobacco." Op-

* Abridged from Blackwood—August 1853.

position only excited more general attention to the plant, awakened curiosity regarding it, and promoted its consumption.

So in the East—the priests and sultans of Turkey and Persia, declared smoking a sin against their holy religion, yet nevertheless the Turks and Persians became the greatest smokers in the world. In Turkey the pipe is perpetually in the mouth; in India all classes and both sexes smoke; in China the practice is so universal that "every female, from the age of eight or nine years, wears as an appendage to her dress a small silken pocket, to hold tobacco and a pipe." It is even argued by Pallas that the extensive prevalence of the practice in Asia, and especially in China, proves the use of tobacco for smoking to be more ancient than the discovery of the New World. "Amongst the Chinese," he says, "and amongst the Mongol tribes who had the most intercourse with them, the custom of smoking is so general, so frequent, and has become so indispensable a luxury; the tobacco purse affixed to their belt so necessary an article of dress; the form of the pipes, from which the Dutch seem to have taken the model of theirs, so original; and, lastly, the preparation of the yellow leaves, which are merely rubbed to pieces and then put in to the pipe, so peculiar—that they could not possibly derive all this from America by way of Europe, especially as India, where the practice of smoking is not so general, intervenes between Persia and China."*

Leaving this question of its origin, the reader will not be surprised, when he considers how widely the practice of smoking prevails, that the total produce of tobacco grown on the face of the globe has been calculated by Mr. Crawford to amount to the enormous quantity of two millions of tons. The comparative magnitude of this quantity will strike the reader more forcibly, when we state that the whole of the wheat consumed by the inhabitants of Great Britain—estimating it at a quarter a-head, or in round numbers at twenty millions of quarters—weighs only four and one-third millions of tons; so that the tobacco yearly raised for the gratification of this one form of narcotic appetite weighs as much as the wheat consumed by ten millions of Englishmen. And reckoning it at only double the market value of wheat, or two pence and a fraction per pound, it is worth in money as much as all the wheat eaten in Great Britain.

The largest producers, and probably the largest consumers, of tobacco, are the United States of America. The annual production, at the last two decennial periods of their census returns, was estimated at

1840	- - -	219,163,319 lb.
1850	- - -	199,752,646 "

being about one-twentieth part of the whole supposed produce af the globe.

One of the remarkable circumstances connected with the history of tobacco, is, the rapidity with which its consumption and growth have increased, in almost every country, since the discovery of America. In 1662, the quantity raised in Virginia—the chief producer of tobacco on the American shores of the Atlantic —was only 60,000 lb.; and the quantity exported from that colony in 1689, only 120,000 lb. In two hundred and thirty years the produce has risen to nearly twice as many millions. And the extension of its use in our own country may be inferred from the facts that, in the above year of 1689, the total importation was 120,000 lb. of Virginian tobacco, part of which was probably re-exported; while, in 1852, the quantity entered for home consumption amounted to

28,558,753 lb.

being something over a pound per head of the whole population; and to this must be added the large quantity of contraband tobacco, which the heavy duty of three shillings per pound tempts the smuggler to introduce. The whole duty levied on the above quantity in 1852, was £4,560,741, which is equal to a poll-tax of 3s. a-head.

*M'Culloch's Commercial Dictionary, edit. 1847, p. 1314.

Tobacco, as every child among us now knows, is used for smoking, for chewing, and for snuffing. The second of these practices is, in many respects, the most disgusting, and is now rarely seen in this country, except among seafaring men. On shipboard, smoking is always dangerous, and often forbidden; while snuffing is expensive and inconvenient; so that, if the weed must be used, the practice of chewing it can alone be resorted to.

For the smoker and chewer it is prepared in various forms, and sold under different names. The dried leaves, coarsely broken, are sold as canaster or knaster. When moistened, compressed, and cut into fine threads, they form cut or shag tobacco. Moistened with molasses or with syrup, and pressed into cakes, they are called cavendish and negrohead, and are used indifferently either for chewing or smoking. Moistened in the same way, and beaten until they are soft, and then twisted into a thick string, they form the pigtail or twist of the chewer. Cigars are formed of the dried leaves, deprived of their midribs, and rolled up into a spindle. When cut straight, or truncated at each end, as is the custom at Manilla, they are distinguished as *cheroots.*

For the snuff-taker, the dried leaves are sprinkled with water laid in heaps, and allowed to ferment. They are then dried again, reduced to powder, and baked or roasted. The dry snuffs, like the Scotch and Irish, are usually prepared from the midribs— the rappees, or moist snuffs, from the soft part of the leaves. The latter are also variously scented, to suit the taste of the customer.

Extensively as it is used, it is surprising how very few can state distinctly the effects which tobacco produces—can explain the kind of pleasure the use of it gives them—why they began, and for what reason they continue the indulgence. In truth, few have thought of these points—have cared to analyse their sensations when under the narcotic influence of tobacco—or, if they have analysed them, would care to tell truly what kind of relief it is which they seek in the use of it. "In habitual smokers," says Dr. Pereira, "the practice, when employed moderately, provokes thirst, increases the secretion of saliva, and produces a remarkably soothing and tranquilising effect on the mind, which has made it so much admired and adopted by all classes of society, and by all nations, civilised and barbarous." Taken in excess in any form, and especially by persons unaccustomed to it, it produces nausea, vomiting, in some cases purging, universal trembling, staggering, convulsive movements, paralysis, torpor, and death. Cases are on record of persons killing themselves by smoking seventeen or eighteen pipes at a sitting. With some constitutions it never agrees; but both our author and Dr. Christison of Edinburgh agree that "no well-ascertained ill effects have been shown to result from the habitual practice of smoking." The effects of chewing are of a similar kind. Those of snuffing are only less in degree; and the influence which tobacco exercises in the mouth, in promoting the flow of saliva, &c., manifests itself when used as snuff in producing sneezing, and in increasing the discharge of mucus from the nose. The excessive use of snuff, however, blunts the sense of smell, alters the tone of voice, and occasionally produces dyspepsia and loss of appetite. In rarer cases it ultimately induces apoplexy and delirium.

But it is the soothing and tranquilising effect it has on the mind for which tobacco is chiefly indulged in. And amid the teasing paltry cares, as well as the more poignant griefs of life, what a blessing that a mere material soother and tranquiliser can be found, accessible alike to all—to the desolate and the outcast,

equally with him who is rich in a happy home and the felicity of sympathising friends! Is there any one so sunk in happiness himself, as to wonder that millions of the world-chafed should flee to it for solace? Yet the question still remains which is to bring out the peculiar characteristic of tobacco. We may take for granted that it acts in some way upon the nervous system; but what is the special effect of tobacco on the brain and nerves, to which the pleasing reverie it produces is to be ascribed? "The pleasure of the reverie consequent on the indulgence of the pipe consists," according to Dr. Madden, "in a temporary annihilation of thought. People really cease to think when they have been long smoking. I have asked Turks repeatedly what they have been thinking of during their long smoking reveries, and they replied, 'Of nothing.' I could not remind them of a single idea having occupied their minds; and in the consideration of the Turkish character there is no more curious circumstance connected with their moral condition. The opinion of Locke, that the soul of a waking man is never without thought, because it is the condition of being awake, is, in my mind, contradicted by the waking somnambulism, if I may so express myself, of a Moslem."*

We conceive that Dr. Madden might find in England, in Germany, and in Holland, many good smokers, who would make excellent Moslems in his sense, and who at the close of long tobacco reveries are utterly unconscious and innocent of a single thought. Yet we restrict our faith in his opinion to the simple belief, that tobacco with the haze such as its smoke creates, tends to soften down and assuage the intensity of all inner thoughts or external impressions which affect the feelings, and thus to create a still and peaceful repose—such a quiet rest as one fancies might be found in the hazy distance of Turner's landscapes. We deny that, in Europeans in general, smoking puts an end to intellectual exertion. In moderation, our own experience is, that it sharpens and strengthens it; and we doubt very much if those learned Teutonic Professors, who smoke all day, whose studies are perpetually obscured by the fumes of the weed, and who are even said to smoke during sleep, would willingly, or with good temper, concede that the heavy tomes which in yearly thousands appear at the Leipsic book fair, have all been written after their authors had "really ceased to think." Still it is probably true, and may be received as the characteristic of tobacco among narcotics, that its major and first effect is to assuage, and allay, and soothe the system in general; its minor, and second, or after effect, to excite and invigorate, and, at the same time, give steadiness and fixity to the powers of thought.

The active substances, or chemical ingredients of tobacco, or tobacco smoke, by which these effects upon the system are produced, are three in number. The *first* is a volatile oil, of which about two grains can be obtained from a pound of leaves, by distilling them with water. This oil, or fat, "is solid, has the odour of tobacco, and a bitter taste. It excites in the tongue and throat a sensation similar to that of tobacco smoke; and, when swallowed, gives rise to giddiness, nausea, and an inclination to vomit." Small as the quantity is, therefore, which is present in the leaf, this substance must be regarded as one of the ingredients upon which the effects of tobacco depend.

The *second* is a volatile *alkali*, as it is called by chemists, which is also obtained by a form of distillation. The substance is liquid, has the odour of tobacco, an acrid, burning taste, and is possessed of narcotic and highly poisonous qualities. In this latter quality it is scarcely inferior to Prussic acid. The proportion of this substance contained in the leaf varies from 3 to 8 per cent., so that he who smokes a hundred grains of tobacco *may* draw into his mouth from three to eight grains of one of the most subtle of all known poisons. It will not be doubted, therefore, that some of the effects of tobacco are to be ascribed to this peculiar substance.

The third is an oil—an empyreumatic oil it is called—which does not exist ready formed in the natural leaf, but is produced along with other substances during the burning. This is supposed to be "the juice of cursed hebenon," described by Shakespeare as a *distilment*. It is acrid, disagreeable to the taste, narcotic, and so poisonous that a single drop on the tongue of a cat causes immediate convulsions, and in two minutes death.

Of these three active ingredients contained in tobacco smoke, the Turkish and Indian pipes, in which the smoke is made to pass slowly through water, arrest a large proportion. and therefore convey the air to the mouth in a milder form. The reservoir of the German meerschaums retains the grosser portions of the oils, &c., produced by burning; and the long stem of the Russian pipe has a similar effect. The Dutch and English pipes retain less; while the cigar, especially when smoked to the end, discharges everything into the mouth of the smoker, and, when he retains the saliva, gives him the benefit of the united action of all the three narcotic substances together. It is not surprising, therefore, that those who have been accustomed to smoke cigars, especially such as are made of strong tobacco, should find any other pipe both tame and tasteless, except the short black *cutty*, which has lately come into favour again among inveterate smokers.

The chewer of tobacco, it will be understood from the above description of its active ingredients, is not exposed to the effects of the oil which is produced during the burning. The natural oil and the volatile alkali are the substances which act upon him. The taker of snuff is in the same condition. But *his* drug is still milder than that of the chewer, inasmuch as the artificial drying or roasting to which the tobacco is subjected in the preparation of snuff, drives off a portion of the natural volatile oil, and a large part of the volatile alkali, and thus renders it considerably less active than the natural leaf.

In all the properties by which tobacco is characterised, the produce of different countries and districts is found to exhibit very sensible differences. At least eight or ten species, and numerous varieties, of the plant are cultivated; and the leaf of each of these, even where they are all grown in the same locality, is found to exhibit sensible peculiarities. To these, climate and soil add each its special effects; while the periods of growth at which the leaves are gathered, and the way in which they are dried or cured, exercise a well-known influence on the quality of the crop. To these causes of diversity is owing, for the most part, the unlike estimation in which Virginian, Cuban, Brazilian, Peruvian, East Indian, Persian and Turkish tobaccos are held in the market.

The chemist explains all the known and well-marked diversities of quality and flavour in the unadulterated leaf, by showing that each recognised variety of tobacco contains the active ingredients of the leaf in a peculiar form or proportion; and it is interesting to find science in his hands first rendering satisfactory reasons for the decisions of taste. Thus, he has shown that the natural volatile oil does not exist in the green leaf, but is formed during the drying, and hence the reason why the mode of curing affects the strength and quality of the dried leaf. He has also shown that the proportion of the poisonous alkali (nicotin) is smallest (2 per cent.) in the best Havannah, and largest (7 per cent.) in the Virginian tobacco, and hence a natural and sound reason for the preference given to the former by the smokers of cigars.

*MADDEN, Travels in Turkey, vol. i. p. 16.

As to the lesser niceties of flavour, this probably depends upon other odoriferous ingredients not so active in their nature, or so essential to the leaf as those already mentioned. The leaves of plants, in this respect, are easily affected by a variety of circumstances, and especially by the nature of the soil they grow in, and of the manure applied to them. Even to the grosser senses of us Europeans, it is known, for example, that pigs' dung carries its *goût* into the tobacco raised by its means. But the more refined organs of the Druses and Maronites of Mount Lebanon readily recognise, by the flavour of their tobacco, the kind of manure employed in its cultivation, and esteem, above all others, that which has been aided in its growth by the droppings of the goat.

But in countries where high duties upon tobacco hold out a temptation to fraud, artificial flavours are given by various forms of adulteration. "Saccharine matter, (molasses, sugar, honey, &c.,) which is the principal adulterating ingredient, is said to be used both for the purpose of adding to the weight of the tobacco and of rendering it more agreeable. Vegetable leaves, (as those of rhubarb and the beech), mosses, bran, the sproutings of malt, beet-root dregs, liquorice, terra japonica, rosin, yellow ochre, fullers' earth, sand, saltpetre, common salt, sal-ammoniac"—such is a list of the substances which have been detected in adulterated tobacco. How many more may be in daily use for the purpose, who can tell? Is it surprising, therefore, that we should meet with manufactured tobaccos possessing a thousand different flavours for which the chemistry of the natural leaf can in no way account?

There are two other circumstances in connection with the history of tobacco, which, because of their economical and social bearings, are possessed of much interest.

First, Every smoker must have observed the quantity of ash he has occasion to empty out of his pipe, or the large nozzle he knocks off from time to time from the burning end of his cigar. This incombustible part is equal to one-fourth or one-fifth of the whole weight of the dried leaf, and consists of earthy or mineral matter which the tobacco plant has drawn from the soil on which it has grown. Every ton, when dried, of the tobacco leaf which is gathered, carries off, therefore, from four to five hundred weight of this mineral matter from the soil. And as the substances of which the mineral matter consists are among those which are at once most necessary to vegetation, and least abundant even in fertile soils, it will readily be understood that the frequent growth and removal of tobacco from the same field must gradually affect its fertility, and sooner or later exhaust it.

It has been, and still is, to a great extent, the misfortune of many tobacco-growing regions, that this simple deduction was unknown and unheeded. The culture has been continued year after year upon virgin soils, till the best and richest were at last wearied and worn out, and patches of deserted wilderness are at length seen where tobacco plantations formerly extended and flourished. Upon the Atlantic borders of the United States of America, the best known modern instances of such exhausting culture are to be fond. It is one of the triumphs of the chemistry of this century, that it has ascertained what the land loses by such imprudent treatment—what is the cause, therefore, of the barrenness that befalls it, and by what new management its ancient fertility may be again restored.

Second, It is melancholy to think that the gratification of this narcotic instinct of man should in some countries—and especially in North America, Cuba and Brazil—have become a source of human misery in its most aggravated forms. It was long ago remarked of the tobacco culture by President Jefferson, in his *Notes on Virginia*, that "it is a culture productive of infinite wretchedness. Those employed in it are in a continued state of exertion beyond the powers of nature to support. Little food of any kind is raised by them, so that the men and animals on these farms are badly fed, and the earth is rapidly impoverished." But these words do not convey to the English reader a complete idea of the misery they allude to. The men employed in the culture, who suffer the "infinite wretchedness," are the slaves on the plantations. And it is melancholy, as we have said, to think that the gratification of the passion for tobacco should not only have been an early stimulus to the extension of slavery in the United States, but should continue still to be one of the props by which it is sustained. The exports of tobacco from the United States in the year ending June 1850, were valued at ten millions of dollars. This sum European smokers pay for the maintenance of slavery in these states, besides what they contribute for the same purpose to Cuba and Brazil. The practice of smoking is in itself, we believe, neither a moral nor a social evil; it is merely the gratification of a natural and universal, as it is an innocent instinct. Pity that such evils should be permitted to flow from what is in itself so harmless!

(To be continued).

The Electric Light.

Suggestions for some new methods for its management by
CHRISTOPHER BINKS, ESQ.

In the ordinary arrangements of the carbon electrodes used for producing light by the passage through them of a current of voltaic electricity, two rods or pencils of solid charcoal are employed, and these, held vertically, are placed end to end, the straight line formed by them being broken at the point where the two ends meet, between which ends is left a minute intervening space, measuring generally from about $\frac{1}{16}$ to $\frac{1}{4}$ inch, according to the strength of the passing current of electricity. These rods though not in actual contact at their points, form part of the circuit, connecting together the two poles of the exciting battery; for the so-called current of electricity passes through the intervening space, giving rise, in its passage, to the peculiar phenomenon of the electric light. So evolved, however, its intensity is in all such arrangements, perpetually varying; for the quantity of the light varies according to the distance, one from the other of the carbon ends or points, and this distance is continually altering, either through alterations in the power of the battery, or through the burning away of the carbon by the disintegrating action upon it of the current of electricity, or through the transference which continually takes place of particles of the carbon from the one electrode to the other. The result, in most or in all cases hitherto, is the production of a light that is intermittent—the effects of fluctuations in the quantity of light evolved from time to time, and which no contrivance that has yet been applied with a view to the maintaining of the carbon points at a fixed distance, under the existing conditions of change peculiar to the elements engaged, has hitherto been able to obviate.

I would suggest, firstly, in place of forming each electrode (whether made of carbon or any other material) of a single rod or pencil, as heretofore, that it be formed of two, three, four, or more separate rods or pencils, and, consequently, have as many light-emanating points as there are separate rods, and that these rods be placed close together, and all act together at their points, as a common centre of emanation for the production of one light; so that the chances of *perceptible* variations in the amount, and in the effects of the light evolved, shall be reduced in the proportion to the number of points in the electrode from which the light emanates, and that are brought into action at one and the same time.

This kind of arrangement I would call a *compound electrode*. A negative compound electrode may consist, for example, of two

three, four or more, solid cylinders, or rods of charcoal, or other material, placed side by side, close together, but without actual contact, and having as many points as there are rods brought in juxta-position (for the light emanating points) to the opposite or positive electrode. And the opposite or positive electrode in such an arrangement may consist of several cylinders or rods, placed and acting side by side, or of only one cylinder or rod, with its extremity brought into close juxta-position with the ends or points of the opposite compound electrode. The group, or bundle of separate cylinders, forming a compound electrode, may have one common connection with the battery; or each rod or cylinder may itself be made to constitute an independent conductor of the current.

In all arrangements of light-giving electrodes, wherein the material forming the electrode is destructible, as charcoal is, one of the electrodes under the action of the electric current, is more rapidly worn away than the other; and the one least acted on is called the "non-consuming," and the other the "wasting" electrode. In practically using these proposed compound electrodes, I would suggest, out of the numerous modifications of them that can obviously be adopted, the employment of a single rod of charcoal or other material for the "non-consuming" electrode, and the placing of this undermost: whilst the "wasting" electrode is composed of a combination of *three* separate rods, connected by one common conductor with the battery. But both the electrode may be "compound," and the individual parts of each be collectively connected with the battery; or each of its parts or rods may have an independent connection with the battery. And the "non-consuming" electrode may be a "compound" one, whilst, the "wasting," electrode is made to consist of only a single rod.

But howsoever varied in its details, the character of the proposed plan is the same—resorting for re-adjustment from time to time of the distance one from the other of the acting electrodes, to any of the ingenious plans already in existence for the accomplishment of this object when applied to the single-rod electrodes and which contrivances are equally applicable to these compound electrodes—in place of one point of emanation only, as heretofore, formed by the approximation of the ends of single rods, to have several points of emanation for each light obtained by the employment of compound electrodes, from each of whose points the light is evolved.

In an arrangement, for example, in which *three* of charcoal form a compound wasting electrode, should *one* of three points referred to come to be removed from the opposite electrode beyond the maximum light distance, through waste or transfer, or otherwise, then a quantity of the current of electricity that would otherwise pass through this *one* point is transferred to and passes through the other *two* points that are still within full acting distance from the opposite electrode; and this transference of the current or concentration in two, instead of in three of the rods, serves immediately to increase the action of, and consequently the quantity of, light given out by these two more active points. In the same way it results if *two* instead of *one* of the points be thrown out of action fully or comparatively, and only *one* of the three remains close enough to the opposite electrode, and consequently in full activity—a more active current passes through this one remaining active point, and the light it gives out is increased in proportion, or in a proportion that neutralises the defects in the non or less active points.

After the same manner it occurs when in place of a compound electrode of three points, one consisting of four, five, or of any other greater number is used—the wasting of the material of the electrode, or the shifting in distance from the opposite electrode of all the points in such compound electrodes, can seldom, if ever, take place exactly to the same extent, and exactly at the same moment of time; consequently, a failure in any one point to give out light, or its full amountof light, is comparatively unimportant; and the points that are the least wasted or shifted do, by their consequent increased action, compensate for or reduce the effects of such deficiency to an extent that no contrivance when applied to the old or single rod electrodes has yet been able to secure.

Secondly, there is a certain point in the space between the electrodes, or a certain distance of the one electrode from the other, in all arrangements intended to produce light by the electric current, at which the maximum quantity of light is obtained, but which point is not that of *actual* contact, nor perhaps that the most immediately preceding actual contact in the act of approaching to it. But this maximum light point—or the exact distance corresponding with it, is that which photo-mechanists have hitherto attempted to secure and maintain by a fixture of the electrodes at it, or by contrivances for replacing the points of the electrodes in it when shifted through changes in the structure of the charcoal, by disintegration or transfer, or through alterations in the power of the electric current. But as a solution of the mechanical difficulties that unquestionably exist (whether applied to the single-rod or to the above newly-proposed compound electrodes), in the way of keeping the carbon points or electrodes always at the right striking distance, I would suggest that we should not fix, or attempt to fix, the distance of the electrodes at this point, or to replace them in any fixed position when accidentally shifted from it through structural changes in the carbon, or through variations in the acting condition of the battery, requiring corresponding changes in the relative position of the electrodes, but, on the contrary, that we should bring into action a converse method—that is, I would cause the electrodes, one or both, or all of them, if there should be more than two in the arrangement, successively to approach to, but without actual contact, and to recede from each other by such a movement imparted to one or both, or all of the electrodes, that their relative distance, or the space between them, shall, within certain limits, be continually changing; and this so rapidly that the eye shall be unable to detect the different intensities of the light evolved under the different distances of the electrodes, or when they are the nearest to, and when the farthest apart from each other.

In other words, I would cause the electrodes to be continually changing their relative position, and in doing so to travel through a certain space within the limits of which is embraced the maximum-light point. In this way is obtained a light, the effect or intensity of which is the mean of all the quantities evolved within the space through which the electrodes travel; and which light is apparently steady and invariable, by reason of the rapidity of the movement, and the consequent incapacity of the eye to detect the differences that really occur.

We can obtain these changes in position of the electrodes, or in their relative distance, and the consequent results, by imparting, by any convenient mechanical contrivance, a vibratory, an oscillating, or a rotary movement to one of the electrodes, whilst the other remains stationary, or by giving such motion to both electrodes, or to any set or number of electrodes. And we can either employ a single arrangement of electrodes (that is, a single positive, and a single negative electrode, constituting together a *set*), as the source of the light, or combine together for one light the effects of two or more such *sets*.

The particular motion for working the electrodes may be

obtained by the vibration of a wire or wires carrying the charcoal points, and which points, in the act of vibrating, successively approach to, and recede from, each other, within limits that may be adjusted and regulated according to the power of the current of electricity in use; or the motion can be given by the vibration of a metallic fork, carrying the carbon on each branch; or by an eccentric wheel movement, carrying the electrodes within the required limits rapidly towards, and then away from each other, on each revolution; or by the revolution of two discs on a common axis, but revolving in contrary directions, carrying carbon arms or radii, acting as the electrodes and crossing each other scissor-wise, but without actual contact at any time, and in this way causing the light-emanating points or edges successively and continually to close upon, and to separate from each other; or the motion can be obtained by the rapid revolution of two carbon wheels with serrated edges placed and acting edge to edge; or by the revolution of two wheels or rings, placed concentrically with the proximate, or light-emanating portions serrated, or made angular; or the like results can be obtained by a variety of other forms and arrangements of the electrodes, and the requisite motive-power be supplied by clock-work, by magneto-electric action, &c.; but, howsoever arranged or accomplished, mechanically, I would cause the electrodes alternately to approach to, and to recede from each other, by a movement so rapid that a light free from any sudden or apparent fluctuations is produced.

If with a battery there be connected two wires (thick enough not to have their elasticity affected by the heat of the current,) each carrying a ball of solid charcoal, the two balls acting as the electrodes, and these wires be stretched out parallel to each other, and be made to vibrate, so that the carbon balls shall come close together on each vibration but not into actual contact, we have a beautiful illustration of the pure light that vibrating electrodes may be made to yield, when all other essential conditions (as the renewal of the carbon) are provided for.

Again, if two narrow and longish slips or pencils of charcoal (forming the terminals of the circuit, or, in other words, the electrodes) be placed parallel, and close together, and be made to revolve on an axis in contrary directions, scissorwise, they yield a light which, when viewed from a direction in the plane of their revolution, appears as a *long pencil*, and when at right angles to that plane, as a *broad disc* of light, a method which supplies at once and readily a means of diffusing over almost any area the too intense light hitherto obtained by emanation from the minute point of the ordinary electrodes. The light in this arrangement, comes, of course, only from the points of the carbon that at any moment are the nearest together, but so rapidly does the change in position from one point to the other take place in the act of revolving, that the result is the impression on the eye either (according to what direction seen from) of a pencil or of a disc of light, the former of the entire length of the slips carbon used, the latter the size of the area of a circle, the diameter of which is the entire length of the slips.

In reference to a *diffused* electric light, the product of the action of those or of any other kind of *diffusing* electrodes, the writer need not point out among numerous other uses, its important applications in photography.

New uses of the Leaf of the Pinus Silvestris.

Not far from Breslau, in Silesia, in a domain called *la Prairie du Humboldt*, exist two establishments, equally astonishing on account of their objects and of their connexion; one is a manufactory in which the leaves of the pines are converted into a sort of cotton or wool; the other offers to the sick, as a salubrious bath, the waters left from the making of this vegetable wool.—Both were founded under the head Inspector of Forests, M. de Pannewitz, the inventor of a chemical process, by means of which from the long and slim leaves of the pines is procured a very fine filamentous substance, which has been called *wood-wool, (laine de bois,)* because it curls, felts, and may be spun like common wool.

The *pinus silvestris*, or wild-pine, whence this new product is procured, is already much esteemed in Germany, on account of several valuable advantages which it presents; and, in place of abandoning it to its natural growth, extensive plantations of it have been formed, which are true forests. When planted on light and sandy soils, which it prefers, and in which it grows with the greatest rapidity, it gives them consistency and solidity. Associated with the oak, it becomes shelter, under the shadow of which this latter acquires a great strength of development, until in its turn it rises above its protector. When the pine has reached its fortieth year, it furnishes very profitable crops of resin. Its wood is esteemed for buildings, &c. The employment which M. de Pannewitz has proposed to give to its leaves will, without doubt, contribute to spread still more the culture of a tree already so useful, and will perhaps, give it some favor in other countries where it is scarcely known.

All the acicular leaves of the pines, the firs, and coniferous trees in general, are composed of a bundle of fibres extremely fine and tenacious, which are surrounded and held together by a resinous substance in thin pellicles. When by heat, and by the employment of certain chemical reagents, the resinous substance is dissolved, it is easy to separate the fibres from each other, to wash them, and to free them from all foreign bodies. According to the method used, the woolly substance acquires a finer quality, or remains in a coarser state; and in the first case it is employed as wadding; in the second, as filling for mattresses. Such, in a few words, is the account of the discovery due to M. Pannewitz.

In practice, the *pinus silvestris* has been preferred to others because it has the longest leaves. There is no reason to doubt that in the countries in which other species of pines exist with equally long foliage, the same product may be as advantageously obtained. There is no danger in stripping the pine of its leaves even in its youth. This tree has need for its growth only of the whorls of leaves which terminate each branch; all the leaves which surround the rest of the branch may be stripped off without doing any harm. The operation must take place while they are green, for it is only then that they can serve for the extraction of the woolly substance. The stripping of the leaves is the province of poor people, and pays them good wages. The operation can only be performed every two years. The product of each gathering is one pound of leaves for a branch of the thickness of the finger. A beginner can gather thirty pounds per day; an experienced hand may get as much as one hundred and twenty. The profit is greater from a felled tree than one standing.

The first use which was made of this filamentous substance was to substitute it for cotton wadding in quilted coverlets. In the year 1842, the hospital of Vienna bought five hundred of these coverlets, and, after using them for several years, renewed its orders. It was remarked, among other things, that, under the influence of pine-wool, no kind of parasitic insect harboured in the bed, and the aromatic odour which they emitted was considered to be agreeable and beneficial. Soon afterward, the penitentiary of Vienna was provided with the same kind of cover-

lets. Since then they have been adopted, as have been also mattresses filled with the same wool, in the hospital La Charitè at Berlin, and at the hospital La Maternitè, and the soldiers' quarters at Breslau. An experience of five years in these establishments has shown that the *wood-wool* is well fitted for use in coverlets, and for wadded goods, and is very durable.

At the end of five years a mattress of wood-wool had cost less than one of straw, which required the addition every year of at least two pounds of fresh straw. Furniture, in the construction of which this matter was used, was preserved from the attacks of moths. It cost three times less than hair, and the most skilful upholsterer could not distinguish an article of furniture in which it is used from a similar one stuffed with hair. We are, besides, assured that it may be spun and woven. The finest gives a thread resembling that of hemp, and is as strong. When spun, woven, and finished like cloth, it furnishes a product which may be employed for carpets, horse-furniture, &c.; when interwoven with a warp of linen, it may be used as bed coverings. The products of the manufactories of Zuckmantel and La Prairie d'Humboldt gained for their present owner, M. Weis, a bronze medal at the exhibition of Berlin, and a silver medal at that of Altenburg.

In the preparation ot the *wood wool* there is produced an ethereal oil with sweet odour. This is at first of a green colour; exposed to the light, it takes an orange-yellow colour; when carried into a dark place it regains its green colour; by rectification it becomes as colourless as water. It has been shown to differ from the essence of turpentine, which is extracted from the stem of the same tree. Employed in various rheumatic and gouty affections, and applied as a balm upon wounds, it has produced salutary effects; as also in vermicular affections, and in the case of certain cutaneous tumours. When rectified, it answers as an excellent oil in the preparation of the finest lacs, which form the base of varnishes; and has been burned in lamps like olive oil. It dissolves caoutchouc completely, and in a short time. The perfumers of Paris use quite a large quantity of it.

It has been found that the liquid residuum which the boiling of the pine leaves leaves, exercises a very salutary action when employed as a bath; so that a bathing establishment has been annexed to the manufactory. This liquid has a greenish colour, verging on brownish; according to the circumstances and the mode of preparation, it is either gelatinous and balsamic, or acid: in this latter case prussic acid is produced. During the nine years since the establishment of the baths, their reputation and the number of their visitors have been constantly increasing.

When it is necessary to augment the efficacy of the baths, there is added an extract obtained by distillation of the ethereal oil of which we have spoken, an extract which also contains prussic acid. The liquid residuum is also concentrated to the consistency of a liquid extract, and then enclosed in sealed vessels to be used for baths at home.

The membraneous substance which is obtained by filtration when the fibre is washed is put in the form of bricks, and dried; it then serves as a combustible, and produces a large quantity of gas for lighting, which comes from the great quantity of resin which it contains. Henceforth, it may be used for heating and lighting the manufactory.—*Bib. Univ. de Genevi.*

Manufacture of Sugar—Sugar Extracted from Molasses.

The manufacture of beet sugar has for some years been largely carried on in France. In ten years, the production has doubled notwithstanding the successive duties which have been laid, duties of an excessive character, since 100 kilogrammes of white loaf sugar pay 50 francs of duties, and sell at 150 francs. In 1842, the production of beet sugar throughout France was about 40 millions kilog., and to-day it is 80 millions. This progress has been owing to improvements each year in the manufacture.

Among these improvements, the most important is that called the *barytic*, introduced by MM. Leplay and Dubrunfaut, and which enables them to obtain 50 p. c. of the chrystallizable sugar contained in the molasses. It is well known, that for a long time this molasses was of little value. Its sugar was supposed to be wholly unchrystallizable, and its only use was for making alcohol by fermentation, for which purpose large distilleries had been constructed. In an establishment of this kind, directed by M. Leplay, 12000 killogrammes of the beet molasses were consumed per day, in making alcohol of 94 p. c., which was wholly used in the manufacture of fine liquors.

M. Leplay and M. Dubrunfaut, were the first to recognize that the sugar in the molasses was a sugar perfectly chrystallizable, and having all the characters of ordinary sugar; and that to chrystallize it, it was only necessary to separate the interfering foreign substances, by operating on the juice of the beet which furnishes the molasses. The solution of the problem was one of great importance, since the amount of molasses annually produced in France, was 40 millions kilog., containing more than half its weight of sugar.

Their process, as I have studied it for some years at the establishment of La Villette, near Paris, is as follows. It is based on the insoluble compound, which sugar forms with baryta. When a boiling solution of caustic baryta at 30 ° Baumé, is poured into the ordinary molasses, the substances contained immediately solidify into a porous crystalline mass, insoluble in water, and admitting therefore of thorough washing.

After being thus purified, the saccharate of baryta is white, and has the appearance of a "bouille epaisse;" it is exposed to a current of carbonic acid, which takes up the baryta and sets the sugar at liberty. This operation is carried on in large vats of wood, 80 to 100 hectoliters in size, into which strong pumps worked by steam, inject carbonic acid obtained by the calcination of carbonate of lime in lime furnaces.

While the reaction of the carbonic acid is going on, it is observed that the "bouillie" of saccharate, before very thick, gradually liquifies, and when complete, the whole is a solution of sugar containing carbonate of baryta in suspension.

To separate the carbonate, the mixture is put up into sacs made of cotton fabric, through which the syrup filters clear, while the carbonate is retained. These sacs, after draining thoroughly, are pressed lightly in a screw press, and then subjected to a heavy hydraulic pressure, in order to extract the syrup from the carbonate. This syrup thus obtained, marks 18 to 22 ° Baumé, it is white, of agreeable taste, and holds in solution some traces of the carbonate and bicarbonate of baryta which may be removed by means of a sufficient quantity of plaster, or of sulphate of alumine. Finally, it is clarified by means of dried blood; it is skimmed and filtered, and boiled down like a syrup for the refinery, after which it is put into forms for chrystallizing. We thus obtain, at once, sugar equal in quality to the finest sugars of commerce.

With regard to the residues of this process—the carbonate of baryta, saline substances contained in the molasses, quicklime proceeding from the calcination of the limestone, etc., I have learned

the following facts. The carbonate of baryta may be used an indefinite number of times; it is rendered caustic anew after each operation, by mixing it with charcoal and heating it, and so it serves again. The loss of the baryta, which is unavoidable is resupplied from sulphuret of baryum which M. Leplay prepares by calcining sulphate of baryta with 45 p. c. of charcoal, in a reverberatory furnace, and which he would prepare more advantageously still if he would apply the process suggested by Gibbs. which consists in reducing the sulphate by the gas of the refinery, The sulphuret of baryum possesses equally the property of precipitating the sugar, only there are two equivalents of sulphur when one of oxygen would suffice. In fact this last case gives,

$$\text{Sugar}+\text{BaO}+\text{HO}= \text{Saccharate of BaO}+\text{HO},$$

whilst the sulphuret affords,

$$\text{Sugar}+2\text{SBa}+\text{Ho}= \text{Saccharate of BaO, SBa}.$$

There is hence lost 1 equivalent of sulphuret of baryum. To avoid this loss, 1 equivalent of potash or caustic soda is added to the molasses under trial; and then on pouring in the sulphuret of baryum, all the baryta is precipitated in the state of a saccharate, and the liquid retains the potassium in the state of a sulphydrate.

$$2\ \text{Sugar}+2\ \text{SBa}+\text{HO}=2\ \text{Saccharate of BaO}+\text{SH, SK}.$$

The use of caustic potash produces a residue with carbonic acid, like the quicklime, and would be too expensive for the purpose, were it not regenerated with each operation. In fact, the waters after washing are collected in boilers, evaporated, and the product then calcined in a reverberatory furnace with some chalk or lime, and fused. The fused substance is cooled, broken up, lixiviated, rendered caustic by means of lime, and the leyes are concentrated as in the manufacture of soda. The potash is thus obtained for a new precipitation of the saccharate

In this operation, they obtain not only the potash added in the process, but also the potash and soda which existed primarily in the juice of the beet, and which, by accumulation in the molasses amounts to about ten per cent.

In this manner, MM. Lepley and Dubrunfaut have succeeded in isolating, economically, the sugar of beet molasses. But is this process applicable to the extraction of cane sugar? Yes, on one condition; that is, if the manufacture of cane sugar can be so conducted as to give molasses free from unchrystallizable sugar. For MM. Leplay and Dubrunfaut have shewn that for 60 to 70 p. c. of sugar in the molasses, there are 30 p. c. of unchrystallizable sugar, which is a result of the method of manufacture, and not pre-existent in the juice of the cane.

There exists, then, great differences between the manufacture of beet-sugar and cane-sugar; in the former, the molasses contains no altered sugar, and in the latter there is a large quantity of altered sugar.

Manufacture of caustic baryta from the carbonate.—We have mentioned above the general process by means of which MM. Leplay and Dubrunfaut reduce the carbonate of baryta. The point is important and we add some further details; for it has required much time and experiment to accomplish it conveniently on a large scale. The process is now so far perfected, that caustic baryta may be obtained at a very low price.

After reducing the carbonate to powder, it is mixed intimately with 20 to 25 p. c. of pulverized charcoal, then put in a reverberatory furnace made of good refractory brick. At a reddish white heat the reduction commences, and the aspect of the mass shows when it is complete. A single furnace will thus reduce in 24 hours 1200 kilogrammes of carbonate of baryta, consuming 12 hectoliters of charcoal in heating, and 4 hectoliters for the reduction. Three workmen are required. When finished, the baryta is collected in metal cases, ("etouffoirs,") large sheet-iron boxes holding about 1 hectoliter,) where it is cooled. The artificial carbonate is usually reduced more easily than the native. However, the native carbonate from England is easily decomposed.—*Correspondence of Silliman's Journal.*

The Mines and Mineral Resources of America.

Having presented, in the last number of the *Mining Magazine*, the outlines of the mineralogical character of the New England States, with a view to call the attention of the student of geology and the practical miner to the abundance of mineral wealth known to exist in those States, and desiring its speedy development, I will now proceed to state facts connected with the existence of mines and minerals in the Middle and Southern States, commencing with the State of

NEW-YORK.

The first mineral I shall notice is the primitive or black oxide of iron, at Brewster's Station, in Putnam County. This is an ore of the ordinary black oxide of iron, which produces a fair yield of iron by the blooming process. It may be 50 per cent., as stated; but I fear this is an over estimate. By analyses, selected pieces, very pure, have yielded 79 per cent. This ore is very abundant, extending through the States of Maryland, Pennsylvania, New Jersey, New-York, Connecticut, Massachusetts, and Vermont, into Canada. In Washington, Franklin, Jefferson, Essex, Clinton, Westchester, and Putnam counties, in the State of New York, it is inexhaustible for all future time. Although expensive in its reduction, it possesses qualities necessary to make a fair article of steel. It is very uniform in character from the shores of the Atlantic to the Pacific Ocean.

There is also an abundance of hematite ore in the towns of Amenia and Ancram, of the same character as the celebrated Salisbury iron of Massachusetts. Lead ore, highly argentiferous, also occurs in several localities in Dutchess County. Amongst the most prominent are the Amenia and Ancram mines. The latter was formerly worked by Colonel Livingston with success; subsequently the mine has passed through several hands without producing any result; but I am informed it is at present presenting an encouraging aspect. At this location is found ancramitic or green oxide of zinc. It is an artificial production, and was discovered in the bottom of an old furnace erected in the year 1744. According to Professor Silliman, this new ore is cadmia. Sulphate of barytes, pyritous copper, black copper, sulphate of iron, molybdate of lead, and sulphate of zinc, are also found at the Ancram mines.

Hematitic iron ore is abundant in the town of Putnam, a little to the south of Ticonderoga. Marl occurs in several localities in New York; among the most prominent are Boker's Falls, Bethlehem, Catskill, Clinton, Coeymans, Hilderburg, North-East, Rhinebeck, Dutchess County, and in Saratoga, Ulster, and Washington Counties. Little doubt can be entertained that these deposits of marl are to be brought into use by the agriculturist, as most of them possess, in an eminent degree, the fertilizing principles necessary to aid the growth of vegetation. There are many bogs containing excellent peat, not unlike the Irish turf, which is susceptible of being made a very superior article of fuel; but I doubt if it will ever be wofked successfully for tallow, oil, soda, pyroligneous acids, or any of the ingredients that have been

extracted from the Irish *peat.** The following are among the most desirable localities:—Canaan, Clinton, and the towns of North-East, Washington Hollow, and Rhinebeck, in Dutchess County, as well as many other places in the river counties. I am inclined to believe that this substance, properly prepared, where it is not underlaid with marl, may be used in the reduction of the hematite ores to advantage.

Iron Ore.—As this ore is the most abundant mineral and its use almost universal, it may not be out of place to notice some of its important localities in the State of New-York. At Bethlehem, hematite and bog ores are found; at Calais, black oxide of iron; at Canajoharie, hematite. On the West side of Lake Champlain, in Washington, Essex, Clinton and Franklin Counties, is found, in unlimited quantities, magnetic oxide of iron existing in gigantic mountains, and in veins and beds, from one to twenty feet thick; also, specular oxide of iron, iron sand, red hematite, red oxide and brown hematite. At Catskill, specular iron ore is found; at Cold Spring, magnetic iron and iron sand; at Guilderland, bog ore; at the Highlands, magnetic oxide of iron; at Hillsdale, hematite ore; at Malone, black oxide of iron; at Lyons, Wayne County, argillaceous oxide of iron; at Monroe, Orange County, black oxide of iron, very abundant (octahedral iron); at New Lebanon, hematite; at New-York city and island, large beds of bog ore, containing large quantities of manganese; the oxide of manganese is contained in hollow and friable pebbles, very pure; red oxide of iron and green phosphate of iron at Staten Island; black oxide of iron, hematitic iron and chromate of iron in Oneida and Ontario counties, likewise lenticular iron ore, in immense beds, and also in Madison County. Scaly red oxide of iron occurs along the shore of Lake Ontorio; and in Saratoga, magnetic iron, hematitic iron, and magnetic oxide, lenticular, argillaceous oxide of iron; in fact, almost every town in the county has workable veins or beds of iron ore. Lenticular, argillaceous oxide of iron is found, also, in the town of Vernon; arsenical iron in the town of Warwick; granulated oxide of iron at West Point; lenticular argillaceous oxide of iron occurs in the town of Williamson and at Carthage, Jefferson County. In Hamilton, Montgomery, St. Lawrence and Lewis counties, ores of iron, in great abundance and purity, exist in the vicinity of dense forests capable of furnishing fuel of the best kind, with water powers of vast magnitude sufficient to propel the machinery necessary for its reduction. As the coal fields of England, Scotland and Wales, are giving out, may we not hope soon to hear the forests of Northern New York resound with the note of preparation to make the hidden treasures of the earth subservient to man, and thus for ever shut out the pauper product of the Old World? For whilst the English landed proprietors refuse to use our sugar and our cotton because it is the product of slave labor, we consent to use their iron, produced by a system of slavery that would make the iron itself sweat drops of blood were it possible.

Lead ores are found in the following localities:—Cambridge, Canaan, Canajoharie, Carlisle, Catskill, Claverack, Florida and Greenbush. In Lewis County, near the village of Martinsburg, there is an extensive lead and zinc mine of great value, and which cannot fail to be remunerative to parties working the same. It is on the estate of a Mr. Arthur. Lead is found also at Rhinebeck, Salisbury, and Shawangunk Mountains. At the latter, the mine has been worked both for lead and zinc at intervals, but it is evident the vein is copper; and it will eventually be worked successfully. At the Sing Sing silver mine, the vein is highly argentiferous, accompanied with masses and sheets of metalic silver. It was extensively worked by Sampson Simpson, Henry Remsen, Colonel James and others, from the year 1764 to 1776, when the smithy houses were removed by the Continental army to West Point. Valuable specimens of the metallic silver have been preserved by the heirs of Mr. Simpson. Lead also occurs in the towns of Vernon, Wawarsing, Westmoreland, White Creek, and in several other localities. So far as I am acquainted but six of the mines are now worked, one at Wawarsing, the Ulster lead and the Ancram mine, and one in Dutchess County near the residence of Judge Boker, but with what success the writer is unadvised; also, in the northern part of St. Lawrence County, they are working "the Great Northern," formerly "the Rossie" lead mines, and the St. Lawrence Mining Company's mine, and I believe both companies are producing lead. Copper also occurs in several places in the State of New-York, of which the following are the most prominent: At Shawangunk Mountains, the yellow sulphuret; at Ancram, yellow sulphuret, and black oxide, and green carbonate of copper; at Canajoharie, green carbonate of copper; and at Catskill Mountains, green carbonate or malachite of copper. Antimonial gray copper occurs near Keesville in Clinton County; at Florida there is a green carbonate of copper; also, at Fort Lee; also, at Salisbury, in Saratoga County. Green carbonate and yellow sulphuret of copper are found at Staten Island; detached pieces of copper ore are frequently met with near Fort Tomkins. Sulphuret of copper exists near Ticonderoga; copper is also met with in several places in Wawarsing and Mamakating vallies. At this time I am not advised of more than one copper mine worked in the State of New York, and that is at Crown Point. It is worked by Messrs. Hammond & Co., but what results have been realized the writer is not informed.

Zinc ore occurs in several localities of which the following are the most prominent:—Dutchess County; Columbia County; Ancram; Wawarsing; Shawangunk Mountains; Martinsburg, Lewis County; Verona and Westmoreland, Oneida County; Canajoharie, Carlisle, Clinton near the College, Duphney, Florida Highlands, Niagara Falls and Rome. The above locations produce sulphate of zinc, and chromate and carbonate. Eventually they will be worked when the price of labor is reduced or the demand for lead increased.

Sulphate of barytes is found at nearly all the localities of lead and zinc; also in the bed of the Genesee River near Rochester, and at Pillow Point in Jefferson county, near Sackett's Harbour; also in the town of Smithville.

Manganese.—Occurs on Manhattan Island, Staten Island, at Ancram, and several other places in the State. Perhaps the most important locality is near Martinsburg, Lewis county.

Phosphate of Lime.—Many localities of this powerful fertilizer are known to exist in this State; the most important of these are at Crown Point, and Mariah, Essex county. They have been extensively worked. This mineral occurs in twenty-six different places. One of which is in Washington county; one at Anthony's Nose, and one at Lake George, and in most of the magnetic iron mines in the State; also at the Highlands, also on Manhattan Island. Phosphate of iron occurs also at West Point.

Gypsum.—This valuable mineral exists in many parts of the State. The following are amongst the most valuable localities: Near Cayuga Lake, Cherry Valley, Chittenango, Galway, Lewistown, Oneida Creek, on the shore of Lake Ontario, and below the falls on the Genesee River, at Rochester. In the absence of the phosphate of lime, gypsum seems to abound; and in that

* See Kane and Upjohn's report on value of Irish peat, to House of Lords, &c., 1846.

part of the State where neither have been discovered, marl of a fine quality seems to have been abundantly supplied to fertilize and aid the agriculturist in producing his crops. There are many lime formations suitable for agricultural purposes.

Coal.—This mineral has been found in many localities in this State, but not in workable quantities; and I believe it is now pretty generally conceded that the chances are very much against finding it in quantities. The following localities are the most promising: Sullivan County, Dutchess county near Poughkeepsie, Ancram, Bethlehem, Buffalo, Canajoharie, Clinton and Florida. Bituminous coal occurs near Genesee, Little Falls, Salisbury.

Precious Stones.—The following list comprises the precious stones of this State: jasper, agates, garnets, emerald.

Marbles.—Black marble occurs at Crown Point, also at Glenn's Falls; white marble at Sonth Dover, and white calcareous spar at Pleasantville; all of which is a strong and durable building stone. Marble is also found at several places in Westchester county; also verd antique in Putman county.

Mineral and Salt Springs.—These exist at Saratoga, Ballston, New Lebanon, Cherry Valley, and in Westchester county; Salina, Syracuse, Montezuma, Lenox, and in the town of Ellisburgh, Jefferson county, on the farm of Ezra Stearns, Esquire. The waters are impregnated with salt, and present evidences of having been used before that section of the country was inhabited with the present race of people.

I hope to be able to continue the mineral resources of the State of New York in your next number; but, before I take leave for the present month, allow me to make some remarks designed for the profession of which I claim to be an humble member. I have witnessed with regret a disposition on the part of many individuals to pluck prematurely the honors due to older members of a profession, which cannot be acquired in a day. Since the present renewed interest in mining has taken possession of the minds of the public, the clergyman has left his pulpit, the lawyer his briefs, the druggist his pills, and the shoemaker his wax, and before its odor has been exhaled by his contact with the disinfecting principles of the fresh air, he offers himself as a competent person to examine and report on mines, and take the direction and management of them. Thus the capital invested is often lost, and an unfavorable influence prematurely fixed in the minds of those who have lost their money.

In no pursuit is intelligence, judgment, and experience so requisite; and if duly exercised by those who have these qualities, the developement of the mineral resources of the country will advance under the most favorable auspices.—[*Mining Magazine.*

Limestone and Marble Quarries on the Shores of Lake Couchiching.

The existence of a limestone quarry on Lake Couchiching has long been known to the public. The measurements and short descriptions of the Limestone are given in the Geological Reports for 1845. The probable presence of Lithographic stone is there alluded to, as well as of most excellent building stone, and stone for burning into lime. The quarry known by the name of the Government Quarry, lately leased by Messrs. W. E. O'Brien and Moberly, of this City, does not appear to have been much worked since the time when Mr. Murray made his report in 1845—neither have the exertions to ascertain the existence of layers of Lithographic bands been prosecuted with much zeal, and it is scarcely to be expected that efforts will be made to set the question at rest, until the demand for building stone will so far facilitate the removal of the superimposed layers as to permit the lower bands, where, most probably, the true lithographic stone exists, to be reached without much trouble and expense. We are glad to find that there is now a prospect of the various bands of Limestone forming the shores of this part of Lake Couchiching, acquiring the importance they merit. We have lately had the opportunity of visiting a new quarry, recently opened on the opposite side of the Peninsula on which the old Government Quarry is situated. The name of this quarry is Tor Thorwald, and its enterprising proprietor, Mr. Carlyle, is now engaged in conveying some very magnificent specimens of limestone for building purposes to Toronto. We were much struck with the singular beauty of many of the huge blocks which we saw ready for shipment at Tor Thorwald. We have no doubt that Marble of exquisite beauty is to be found in the quarry. Some of the specimens we examined were delicately veined with pink and blue, and if layers can be obtained without the occurrence of too fragile chrystaline carbonate of Lime, replacing fossils, we do not doubt that marble of singular beauty and value will be obtained. Bands of limestone much approaching that used for lithographic purposes also exist at Tor Thorwald. They are continuations of the same bands which have been already referred to as existing at the old Government Quarry.

During our stay a schooner was taking on board a cargo of lime, to be forwarded to Toronto; the produce of two limekilns constructed within a few feet of the water, which is sufficiently deep to admit of a schooner of 60 tons approaching within two yards of the shore. The limekilns, like the working of the quarry, is at present an experiment, which we do not doubt will be successful, and amply repay the enterprise and courage of the proprietors, Messrs. O'Brien and Moberly. The lime is of a very pure description and will soon find a ready market. We were glad to hear of the safe arrival in Toronto of the first shipment of lime from the lime-kilns of Tor Thorwald—an event of much importance to builders, and one likely to advance the settlement of that beautiful waste, the north-eastern shores of Lake Couchiching. We understand, however. that it is the intention of Mr. O'Brien to establish limekilns at Barrie, in the Spring of 1854, and convey the stone per schooner from his quarries at Lake Couchiching. Toronto and intermediate places will then always be able to secure any quantity of lime of excellent quality at a few day's notice, and at a reasonable charge. We cordially wish this enterprise all the success it so justly merits.

Aurora and Zodiacal Light.

We enjoyed an opportunity of witnessing a very magnificent, and in these latitudes, a rather unusual description of Aurora at Welch Pool, Severn River, on the morning of Tuesday the 6th inst. Waving streamers of pale light, moved with considerable

rapidity from the North-west towards the East. The pale streamers were *apparently* accompanied by dark coloured or rather black waving streamers. At the base of the auroral field —for arch it could scarcely be termed—a dense, long, and very narrow black cloud formed rapidly: the shortest diameter of the cloud was about 10 degrees; it was also removed about 10 degrees from the horizon, and beneath it the stars were plainly visible. When the cloud was fully developed it served as a base, from which a constant succession of long, and unusually broad, pale and black (!) streamers arose. The progress of the Aurora was from North-west to East. The streamers did not appear, in their upward ascent, to converge. Of a sudden, the Eastern portion of the auroral field seemed to be bent back upon itself, and thus, apparently, partially folded, with one part rather lower than the other, the very magnificent spectacle of a nearly circular crown, quite illuminated the North-eastern horizon for the space of two minutes. The time this beautiful phenomenon occurred was about ½ past 3 a. m. It was succeeded by one equally curious, although not so imposing. A few minutes after the auroral crown had disappeared, no trace of any auroral light could be discerned in the Northern horizon. Toward the East, however a very faint pyramid of light, occupied the heavens to the height of about 50 degrees. Supposing that this might still be a portion of the Aurora which we had just been watching, or that the eye might not have recovered its tone after the recent brilliant display of light in the North, we rested awhile, and, after a quarter of an hour, on again looking toward the East, found that the pyramid of light had not only increased in distinctness, but also appeared to have extended itself in all directions, still retaining the form of a gigantic, faintly luminous pyramid. The Zodiacal light, for such it was, remained visible, and with increasing luminosity, until obscured by morning clouds.

Observations of Meteors at the Provincial Magnetic Observatory.

A look-out was kept for the periodic recurrence of the meteoric fall on or about the 10th of August, known as the St. Lawrence Stream, from the time of its occurrence being near St. Lawrence's Day. With the exception of that between the 12th and 14th of November, the St. Lawrence is the most brilliant and best established of all the periodic falls. It was noticed as early as the tenth century, and its constant recurrence about the same time of the year is attested not only by old traditionary legends, but by ancient church calendars, under the poetical title of "St. Lawrence's fiery tears." Scientific attention was drawn to the fact by Muschenbrock in the middle of last century, and it has since been repeatedly confirmed by Quetelet and others.

According to the observations of Julius Schmidt at Bonn, the number of meteors on an average of 8 years was, for August 9th 29 in one hour; and for August 10th, on an average of 6 years 31 in one hour. The observations of Heis shew for the 10th of August, in 1839, a fall of 160 in one hour; in 1840, a fall of 43, and in 1841, of 50 in that time; while, in 1842, there fell in ten minutes no less than 34. The great frequency of these meteors is sufficient to distinguish them from the merely *sporadic* of which a fall of from 4 to 5 per hour may commonly be expected; they are also distinguished by a tendency to parallelism in their directions, and a common point of divergence or convergence.

At Toronto on August 9th, 1853.—None were observed till 9.47 P.M., between which time and 12.40 P.M, there fell 46 meteors; observation was continued for some time longer, but no more were seen. These may be classified as follows, being at the rate of 16 per hour:—

Of first magnitude	2
" second "	2
" third "	5
" fourth "	9
" fifth and lower magnitude	28
In direction N	1
" S	4
" E	2
" W	5
Between N and E	2
" E " S	15
" S " W	11
" W " N	6

There were 10 which left behind perceptible trains, and in general their flight was very rapid and short, only 12 being visible for one second and upwards. The night was very favourable.

On August 10th, 22 were seen between 8.59 P.M., and 12.9, being at the rate of 7 per hour; but the early part of the evening was unfavourable, being thickly overspread with haze. Not one of the first, and only one of the second magnitude fell, the majority being very small. The directions were as follows:—

N, 2; S, 6; E, 2; W, none; N E, 1; N W, 1; S E, 3; S W, 7

Only 2 had tails, and in no case was the time of flight more than half a second.

August 11th was unfavorable, being overcast; only 2 seen.

August 12th was clear, but only 5 fell in 2 hour's observation.

August 13th, observations made for one hour and twenty minutes before the sky became overcast. Not one meteor was seen.

The following remarkable ones were casually observed during the month:—

Aug. 6, at 10.45 P.M.—A very large one moving from S E to W N W, in a course of 20° length; time of flight 2 seconds; large train visible some time after its disappearance; colour very bright, with tinge of orange.

Aug. 8, at 8.50 P.M.—One with a course of 35°, in direction S S E, leaving a tail of a dull orange colour throughout the whole of its path, which lasted for some seconds.

Aug. 10, at 8.10 P.M.—A bright-red meteor; time of flight 2 seconds; direction S W; apparently nearer than the clouds.

Aug. 14, at 10.51 P.M.—A bright red meteor about 6 times as large as Jupiter, falling nearly perpendicularly in the West, and bursting when near the horizon, throwing out numerous sparks of bright yellow; it left a train which, just before bursting, assumed a wedge shape.

Aug. 28, at 7.21 P.M.—One falling diagonally towards horizon in North from star Cor Caroli; length of course 30 °, and time of flight 3 seconds; it threw out sparks during its course of a dull red, and on bursting, of a bright blue colour; its apparent size was twice that of Jupiter, and just as it burst, there was a smoke-like appearance of light round it to a diameter of 7 degrees. J. B. C.

Robert Stephenson, M. P.

The subject of this notice was born at Wilmington, near Newcastle-upon-Tyne, and is the son of the late George Stephenson, of Tapton House, near Chesterfield, in Derbyshire, who from the humblest origin rose to an eminence to which the vast benefits he has conferred on the world justly entitled him. The early life of the elder Stephenson affords a singular contrast to his subsequent history. Born in the village of Wylam, on the banks of the Tyne, near Newcastle; the son of a colliery workman, he had early to labour for a share of the household bread. From picking bats and dross from coal heaps, at two-pence per day, when so young that he used to hide when the overseer was passing, lest he should be thought too small to earn his wages, he became a breaksman on a tram road, and then a stoker to an engine on the estate of Lord Ravensworth, thankful for the advancement of his wages from one to two shillings per day. Here some repairs required by the engine, afforded him an opportunity of displaying that native ingenuity of which he possessed so vast a fund. At this time the dearness of food and the lowness of wages pressed heavily upon him, but his energy triumphed, and as his prospects improved, he gave up the thoughts of emigration to the New World, which he had seriously entertained, and married at the age of twenty-two. On the 16th of November, 1803, his only son Robert was born. Meanwhile, his natural powers of invention and the resources of his mind continued to develope themselves in various ways, so much so, that he early attained a local celebrity, and Lord Ravensworth and other of the Killingworth owners, had sufficient confidence in his ability to advance him sufficient means to build a locomotive, which was first tried on a tramway in 1814. His subsequent success is well portrayed in the following extract from a speech delivered by him on the occasion of opening the Newcastle and Darlington Railway in June, 1844.

"Lord Ravensworth & Co.," said he, "were the first parties who would entrust me with money to make a locomotive engine. That engine was made thirty-two years ago; I said to my friends that there was no limit to the speed of such an engine, provided the works could be made to stand. In this respect, great perfection has been reached, and in consequence, a very high velocity has been attained. In what has been done under my management, the merit is only in part my own. I have been most ably assisted and seconded by my son. In the early part of my career, and when he was a little boy, I saw how deficient I was in education, and made up my mind that he should not labour under the same defect, but that I would put him to a good school, and give him a liberal training. I was, however, but a poor man, and how do you think I managed? I betook myself to mending my neighbours' clocks and watches, at night, after my daily work was done; and thus I procured the means of educating my son. He became my assistant and my companion. He got an appointment as Under-Viewer, and at night we worked together at our engineering. I got leave to go to Killingworth, to lay down a railway at Hetton, and next to Darlington, and after that I went to Liverpool to plan a line to Manchester. I there pledged myself to attain a speed of ten miles per hour. I said I had no doubt the locomotive might be made to go much faster, but we had better be moderate at the beginning: the Directors said I was quite right, for if when I went to Parliament, I talked of going at a greater rate than ten miles an hour, I would put a cross on the road. It was not an easy task for me to keep the engine down to ten miles an hour—but it must be done, and I did my best. I had to place myself in that most unpleasant of all positions—the witness-box of a Parliamentary Committee. I could not find words to satisfy either the Committee or myself: some one enquired if I were a foreigner, and another hinted that I was mad. I put up with every rebuff, and went on with my plans determined not to be put down. Assistance gradually increased, improvements were made—and to-day, a train which started from London in the morning, has brought me in the afternoon to my native soil, and enabled me to take my place in this room and see around me many faces which I have great pleasure in looking upon."

His connexion with the Liverpool and Manchester Line, placed him in the front rank of the engineers of that day, he also became the proprietor of an extensive locomotive manufactory at Newcastle, and an extensive owner of collieries and iron works. His death took place in August, 1848.

We have seen from his own narrative, that George Stephenson fully appreciated the advantages of education, and he has told us of his manly conflict and stern purpose to win the means wherewith to enable his son to receive that training of which he so much felt the necessity himself, and the value of which he held above all price. At the age of ten, Robert was sent to the academy of Mr. John Bruce, of Newcastle, where he remained until about sixteen; he then for a short time received private lessons in mathematics from Mr. Riddell, (afterwards head-master of the Royal Naval School at Greenwich,) and was subsequently apprenticed as a coal-viewer to Mr. Nicholas Wood, in which occupation he remained three years. The name of George Stephenson was by this time rising into eminence as an engineer, and looking forward to better prospects for his son, he removed him from his underground apprenticeship, and in 1821 placed him in the University of Edinburgh, where he studied under Professor Leslie, Dr. Hope, and Professor Jamieson. His father, however, could afford him no more than one session, but during that period he evinced an extraordinary capacity for acquiring knowledge, and a just appreciation of its value. Incited by the early lessons inculcated by the precepts and the examples of his father, and by the necessity that he should be early at the profession he was destined to live by, his diligence knew no pause,—every hour was improved; and he was rewarded by a corresponding proficiency. At the age of nineteen he returned from Edinburgh, and entered upon a new field of study with his father, who had about that time established his steam engine manufactory at Newcastle. Here the same diligence which had characterized his session at the university induced such incessant application to the study of his profession, as to impair his health, and his father, urged by the medical attendant, consented to his son's acceptance of the charge of an expedition to explore the silver and gold mines of Venezuela, New Grenada and Columbia, which had been set on foot by Messrs. Herring, Graham and others. He sailed on this expedition in 1824, and remained in Columbia about four years.

In 1828 he sailed from Carthagena, round Cape Horn, to New York, whence he travelled through that State, and passing into Upper Canada, he visited this city, then known as "Little York," to which the prefix of "muddy" was, as Mr. Stephenson says, justly added. From Toronto he proceeded through the Lower Province, visited Montreal, and finally took ship at Quebec, for England.

When he sailed on his Columbian expedition, the "Surrey Iron Railway," first chartered in 1801, and again in 1803, connecting the Quarries at Merstham and Reigate with Croydon and the Thames at Wandsworth, a length of 21 miles, was the only public "Iron Road" in England; with this exception, the railways of England were private ones, and its commercial success was not such as to encourage the extension of similar speculations. Many private tramways from coal, iron, and other mines were, however, in existence, and on these some progress had been made in the construction of locomotives.

Locomotion by steam on common roads had been vaguely suggested by Watt, in 1759, and practically realized on a small scale by Murdoch in 1784. The idea of applying steam to the propulsion of wheeled carriages did not therefore originate with Richard Trevithick, yet it is to him we are indebted for its first application in a useful form, acting solely by its expansive force. His first engine was tried on the Myrthir Tydvil tramroad, in 1804, with good success, drawing ten tons of useful load, at the rate of five miles per hour. Trevithick's engine had but one cylinder, and was but ill adapted to maintain an equal continuous motion; the adhesion of the driving wheels to the rails was found to be variable, and these difficulties caused him to suggest auxiliary means of propulsion, the presumed necessity for which induced the contrivance and patenting of many expedients, some of them sufficiently ridiculous, and others remarkable only for their intricacy.

Passing over the continuous rack and wheel of Blenkinsop, the notable chains and drums of the brothers Chapman, and the automaton legs of Brunton, we find Mr. Blackett, of the Wylan Railway, recurring to the adhesion of the wheels to the rails which he found sufficient when the weight of the engine was properly distributed. To make available the full power of his engines, he used two cylinders, with the cranks placed at right angles, and thus rendered his engines capable of producing an equal, continuous motion—this was in 1813. In 1814, the elder Stephenson constructed his first locomotive, in which and in his subsequent ones, he introduced several improvements, which gave his engines a superiority over those made by his contemporaries.

Although Mr. Blackett, as we have said, applied double cylinders to produce a continuous motion, his modes of attachment and of connecting the wheels was defective;—the wheels were connected by endless chains. These, however, were sufficient to establish the sufficiency of the *bite* of the wheels to draw the requisite number of loaded waggons, and therefore general attention was re-directed to improving the means of applying the power of the steam to the wheels. George Stephenson first introduced an ingenious arrangement of geering to effect the desired end. His first engine, when tried up an incline of 1 in 450, dragged eight loaded waggons weighing 30 tons, at the rate of about four miles per hour. In practice, however, it was found that the spur geering caused considerable noise and jarring, which increased with the wear. To remedy this, Mr. Stephenson, in connexion with Mr. Dodds, patented in 1815 a method of attaching the connecting rods of the engines to crank-pins fixed in the arms of the driving-wheels, and used endless chains to keep the crank-pins at right angles with each other; for these chains outside connecting-rods were substituted; and, except that Nicholas

Wood added wrought iron tires to the driving-wheels, the locomotive remained for many years in the condition to which Stephenson had brought it.

We have thus briefly noticed the progress of locomotives, in order to show the state of utility to which they had been brought when Robert Stephenson returned to England, in 1828. When he departed for America, in 1824, there were very few locomotives in existence, and during his absence, no very important improvements had been made, except that Mr. Hackworth, of the Stockton and Darlington Railway, had introduced the blast-pipe, (as it had been fomerly applied by Trevithick,) into an engine constructed for that line, which had six coupled wheels, and was capable of drawing a gross load of 100 tons, on a level, at the rate of five miles per hour.

During the same period, however, a new era had commenced in the history of railways. They had received an impetus from the increasing success of the locomotive. The Stratford and Moreton line had been opened for the carriage of goods and passengers,—the Stockton and Darlington was opened soon after; and, notwithstanding the commercial panic and the difficulties which had to be overcome in Parliament, the Liverpool and Manchester line was commenced in 1826, under the unconquerable energies of the elder Stephenson, and his assistant, Mr. Joseph Locke. Mr. Nicholas Wood had also published his well-known "Practical Treatise on Railroads," in 1825, —and, in that year of the wildest speculations, the idea of iron highways and rapid travelling by steam first seized upon the public mind. On the return of Stephenson to England, in 1828, he found the Liverpool and Manchester Railway rapidly approaching completion, and a general desire on the part of the public for a higher rate of speed than had yet been attained. The Directors of the Liverpool and Manchester Railway, in consequence of this feeling, and of the non-existence at that time of locomotives capable of meeting the public requirements, seriously contemplated working their road by stationary engines. Previous, however, to deciding this important question, a commission consisting of Messrs. George Stephenson, Locke, Walker, and Rastrick, was appointed to collect information from the managers of the few railways and tramroads then in existence, as to the best power that could be applied, and more particularly as to the comparative merits of fixed and locomotive power. The result of their report showed a proportion of seven to nine in favour of stationary power.

As, however, it was admitted that several improvements were being made in locomotives, the Directors, influenced by the opinions of their Engineer, and by the careful reasonings of a pamphlet, the joint production of Robert Stephenson and Joseph Locke, determined, at the suggestion of Mr. Harrison, one of their number, to offer a premium of £500 for the best locomotive which should conform to certain conditions, namely,—It must consume its own smoke;—the whole weight of the engine and boiler must be carried on springs;—it must not exceed six tons in weight;—if of that weight it must be able to draw a train of twenty tons, including the tender, at the rate of ten miles an hour on a level railway;—if of greater than 4½ tons weight, it must have six wheels. The conditions also announced that an engine of less weight would be preferred, if it performed an equal amount of work.

The local growth of railways and the sudden impulse given to them in 1825, together with the several patents held by George Stephenson in connexion with locomotives, had been the means of causing his steam-engine manufactory at Newcastle to become exclusively a locomotive manufactory; and to it, during a space of three years after his return from America, Robert Stephenson devoted the greater part of his time,—having charge, however, during the same period, of the construction of the Warrington and Newton and of the Leicester and Sawamington Railways. During this period, as we have seen, the nature of the power to be used on the Liverpool and Manchester line had to be determined,—and Robert Stephenson at once entered into the competition, resolved to outstrip the conditions imposed upon the competitors.

(To be continued.)

Address of the President and Council of the Canadian Institute to Mr. Robert Stevenson, M.P., on the occasion of his Visit to Toronto.

TORONTO, UPPER CANADA,
August 26, 1853.

To Mr. Robert Stephenson, M. P.,—

SIR,—We, the President and Council of the Canadian Institute, take the earliest opportunity to offer you a most cordial welcome to Upper Canada, on behalf of a Society which has for one of its main objects the cultivation of that branch of Science with which your name is so honorably and eminently connected.

Our Institute, founded in 1849 by Royal Charter, for the promotion of the interests of Science and Art in this Province already numbers nearly 300 members, including the most distinguished Scientific and Literary names in both sections of Canada. We have endeavored to carry out our object by holding winter Sessions, in which papers are read and discussion encouraged; and by the establishment of a monthly Scientific Journal, to serve as a record of the transactions of the Institute, and which, though only just completing its first year of existence, has already a circulation of about 500.

Of a copy of this we beg your acceptance.

We are also successfully engaged in forming a Library of Scientific reference, and a museum illustrative of the productions of the Province.

Such being our aims, and the progression we are making towards their attainment, we beg to hope that you will allow yourself to be nominated an honorary member of the Institute,

And we have the honor to be,
With the greatest respect and esteem,
your obedient servants,
The President and Council of the Canadian Institute.

Signed in behalf of the Council of the Canadian Institute.

J. B. CHERRIMAN, M. A.
Vice President.
FRED. CUMBERLAND,
Second Vice President.
A. BRUNEL, *Secretary.*

Mr. STEPHENSON in reply, expressed the deep gratification he had received from the extremely kind welcome he had met with

in Canada, which in the present instance he felt the more, from its being offered by a Society devoted more particularly to that profession in which he had been so long and, as the address stated, successfully engaged. Twenty-five years ago, he said, he had been in this place, when at that time he was poor and unknown, and if the contrast of his second visit struck forcibly as regarded himself, so also did the contrast of the appearance of the city then and now. Little did he imagine then that the village of "muddy little York" could have made such astonishing progress as he saw around him, and he must heartily congratulate the people of this country on their having shown such energy and enterprize: when the various railroads in connexion with the city were in full play, he thought Toronto would not be long in enforcing the title she had ambitiously but not arrogantly seized, "The Queen of the West." Such societies as this, he felt sure, must be productive of much benefit, particularly by means of the discussions that would ensue on the reading of scientific papers: such had been the case with their own Society in London: professional gentlemen would be very careful in putting forward statements, and would investigate their subject more thoroughly, when they knew their opinions and calculations would be liable to acute questioning by the best men of the country. He would be happy to accept a copy of their Journal, the existtence of which did much credit to them, and could not fail to be of the greatest service to the interests of the profession and science generally. He would forward for their acceptance a copy of his work on tubular bridges, and should feel highly honoured at being enrolled in their Society as an honorary member.

In the course of after-conversation, Mr. Stephenson took occasion to pay Mr. Cumberland a very high compliment on the architecture of the Cathedral, and also denounced strongly the American system of Railroads, and the careless, almost wanton disregard of life and property which characterized their management: speaking of the single track lines, he expressed an opinion that they ought never to be used, until the electric telegraph was in operation throughout the whole extent, so that the passage of every train at each station might be communicated at once to every other station. A good-humoured discussion arose upon this, which bade fair to be considerably prolonged, had not the Deputation, mindful of the arduous task Mr. Stephenson had to go through in the evening, felt it a duty to terminate this very pleasing interview.

The Stephenson Dinner.

The description of this elegant testimonial of respect and esteem, on the part of the Civil Engineers of Upper Canada, towards the most eminent Engineer of modern times, has been already widely circulated in every part of this Province. We content ourselves, therefore, with an extract from a lengthy description which appeared in the *Daily Colonist* of August 27th:

"The Civil Engineers have done themselves the credit of getting up, take it for its all in all, the most splendid Public Dinner that ever took place in Toronto. It was worthy of their guest, Robert Stephenson, C. E., whose well-earned world-wide reputation, does honor to the profession of engineer. The Civil Engineers have done well to entertain him in this manner, and for our part we are obliged to them for the opportunity of hearing him speak. The arrangements for the dinner were very good. The old Chamber of the Assembly was used as a reception room, and it answered the purpose admirably; and the dinner tables were laid out in the old Legislative Council Chamber. This last was most tastefully and appropriately decorated, with flags and engineering devices, models and instruments. "Success to Railway Enterprise," was one of the mottoes, and either side of this were, intermingled with the engineering devices, the letters, in large characters, R. S.

"As to the tables, nothing could exceed the good order of the arrangement they displayed, or the tasteful manner in which they were laid out. Nothing was spared; the table service was all that could be desired; the flowers, and fruit, and ornaments produced a striking effect. Every thing was lavish, but nothing *de trop*, the common fault of bad taste.'

Notices of Books.

The *Mining Magazine;* Edited by William T. Tenney, New York. The second number of this new Periodical is full of interesting and important matter; besides several original and selected articles of value it contains a mass of information under the following headings:—Journal of Mining Laws and Regulations; Commercial Aspect of the Mining Interest; Journal of Gold, Copper, Silver and Lead Mining Operations; Coals and Collieries; Iron and Zinc; Quarries, &c.

Journal of Education for Upper Canada. The July, August and September numbers of the *Journal of Education* are sent forth together, in order that the whole of the Catalogue of Books for Public School Libraries, and the Circulars and Regulations respecting the modes of their establishment, may be laid before the Local Municipal School authorities at one and the same time.

In the official Circular from the Chief Superintendent of Schools to Township Councils and Trustees, upon the establishment and management of School Libraries, Dr. Ryerson says:

"In regard to the selection and procuring of the books mentioned in the catalogue, I may observe, that it is not easy to conceive, and it is needless that I should attempt to describe, the amount of time, labour, and anxiety which has been expended in devising and maturing this system of Public School Libraries, in making arrangements in Great Britain and the United States for procuring these books on advantageous terms, and in selecting them from a much larger number of works on the same subjects; nor am I yet able myself to form an accurate idea of the extent of the additional labour and responsibility incurred by making this Department the medium and agent of providing the Public School Libraries throughout the Province with the Books for which the Municipalities may think proper to apply. But on no part of the work which I have undertaken, do I reflect with more interest and pleasure than on that of rendering accessible to all the Municipalities of Upper Canada—even the most remote—books of instruction and useful entertainment which would not have otherwise come within their reach, and that at prices which will save them thousands per annum in the purchase of them—thus adding to their resources of knowledge and enjoyment by the variety and character of books to which they can have access, and the increase of facilities and the reduction of expenses in procuring them."

The Catalogue is evidently prepared with great care and precision There is attached to the name of each important book a short description of its contents, and not unfrequently short extracts of the opinions of men well known by their writings or position.

The regulations subjoined, being two out of eighteen, established by the Council of Public Instruction for the management of School Libraries, exhibit the scope of these admirable adjuncts to our Common School System. It will be seen that the libraries are to be open to the public under certain regulations.

"There may be School Section Libraries, or Township Libraries, as each Township Municipality shall prefer. In case of the establishment of a Township Library, the Township Council may either cause the books to be deposited in one place, or recognise each School Section within its jurisdiction as a branch of the Township Library Corporation, and cause the Library to be divided into parts or sections, and allow each of these parts or sections of the Library to be circulated in succession in each School Section."

"Each individual residing in a School Section, of sufficient age to read the books belonging to the Library, shall be entitled to all the benefits and privileges conferred by these regulations relative to Public School Libraries; but no person, under age, can be permitted to take a book out of the Library, unless he resides with some inhabitant who is responsible for him; nor can he receive a book if notice has been given by his parent, or guardian, or person with whom he resides, that he will not be responsible for books delivered to such minor. But *any* minor can draw a book from the Library, on depositing the cost of such book with the Librarian."

Report of a Survey for the Railway Bridge over the St. Lawrence at Montreal, by T. C. Keefer, C. E.—We should have had much pleasure in giving an extended notice of Mr. Keefer's Report, had we enjoyed the opportunity of acknowledging the receipt of a copy; that privilege, however, being denied to us, we are unable to gratify our readers with any description of the propositions submitted by Mr. Keefer, for the construction of one of the most magnificent engineering works of the day.

American Association for the Advancement of Science.

The seventh meeting of the American Association was held at Cleveland, during the week following the 28th of July. Professor B. Pierce, of Cambridge, was President for the year. The meeting was less well attended than those of former years, owing partly to the engagements of many of the members of the Association at the different institutions of the country, with which they are connected. Among the papers presented, those of the departments of Physics and Mathematics were much the most numerous, and were mostly of high merit. There were but few papers brought forward in Geology, or Chemistry. The meeting adjourned on Tuesday, the 2d of August, to meet in Washington, on the last Wednesday of April, 1854.

A committee for revising the constitution of the Association was appointed, consisting of Prof. Bache, Dr. J. Lawrence Smith, Dr. Le Conte, of Georgia, Dr. W. Gibbs, of New York, Dr. B. A. Gould, Jr, Prof W. B. Rogers, Prof J. D. Dana, Dr. J. Leidy, Prof. S. S. Haldeman, and Dr. A. A Gould. Resolutions were passed reducing the annual assessment from $3 to $1, and requiring that the Proceedings should be furnished to members at cost, or free of expense when the Proceedings are published by the public liberality of the city where the meeting may be held.

The following officers were appointed for the ensuing year: Prof. J. D. Dana, President; Prof. J. Lovering, of Cambridge, General Secretary; Prof. J. Lawrence Smith, Permanent Secretary, and Dr. Elwyn, Treasurer.

Dr. B. A. Gould. Jr., was requested to prepare an obituary of the late Sears C. Walker, to be presented at the meeting at Washington.

The following is a list of the papers read at the Cleveland meeting. We deem it the only just course to authors not to publish abstracts of their papers, unless such abstracts are made out by themselves, and sent to us expressly for publication.

(1.) *Physics, Mathematics, Astronomy.*

Prof. B. Peirce, of Cambridge, Mass.: Investigations in Analytical Morphology: No 1, Description of the Science; 2, Stable and Unstable forms of Equilibrium; 3, Forms of the Elastic Sac; 4, Stability of Saturn's Ring.

—— Personal Scale of Astronomical Observers.

—— Criterion for the rejection of doubtful observations.

—— Theory of the action of Neptune upon Saturn.

Prof. A. D. Bache, Supt. Coast Survey, Washington: On the Tides at Key West, Florida, from observations made in connection with the U. S. Coast Survey.

—— On the Tides of the Western Coast of the United States, from Observations at San Francisco, California, in connection with the U. S. Coast Survey.

Prof. Stephen Alexander, of Princeton: On some special analogies of Structure in the Eastern Hemisphere of the Earth and the visible Hemisphere of the Moon, with conjectures as to the structure and Appearance of those portions of the Moon which are invisible.

—— On some Relations of the Central Distances of the Primary Planets, Satellites, and Rings of the Solar System, of which Bode's Law would seem to be but an imperfect expression.

—— On the Primitive Form and Dimensions of the Asteroid Planet, the cause of the Instability of the same, and of the Varieties in the Orbits of the Asteroids.

Prof W. Chauvenet, of the U. S. Naval Academy: On the method of finding the error of a Chronometer by equal altitudes of the sun.

—— New Formulas of Spherical Trigonometry.

Dr. B. A. Gould, Jr, of Cambridge, Mass.: On Personal Equations in Astronomical Observation.

—— On the Velocity of Transmission of Electric Signals along Iron Telegraph Wires.

—— On the comparative precision of the Electro-chronographic or American Method of Observation.

Prof O. M. Mitchel,: On a New Method of securing Uniform Circular Motion in the Machinery used in receiving the Registration of Astronomical Observations of Right Ascension.

Prof. C. W. Hackley, of New York: Mathematical Analysis of the contact of surfaces in oscillating Machinery.

Lt E. B Hunt: On Cohesion of Fluids, Evaporation, and Steam Boiler Explosions.

—— The Conical Condenser, a Telescopic Appendage.

Prof. John H. C. Coffin, of the Washington Observatory: Some errors peculiar to the observer, which may affect determinations of the declinations of the Fixed Stars.

Dr. Julius Friedländer, of Berlin: On the limit toward which the series,

$$1+\frac{1}{2^1+p}+\frac{1}{3^1+p}+\frac{1}{4^1+p}+\text{\&c.},$$

converges for $p=0$.

Prof. O. N. Stoddard, of Miami University: Strictures on the mechanical explanation of the zig-zag path of the Electric Spark.

Prof. J. L. Riddell, of New Orleans: Theory of Molecular Forces, explanatory of the gaseous, liquid, and solid conditions of matter.

Prof. Joseph Henry, of Washington: Illustrations of Cohesion.

Prof. Joseph Lovering, Cambridge: On a Modification of Soleil's Polarizing Apparatus for Projection.

——: On a singular case of internal Fringes, produced by interference in the eye itself.

Prof. George Perkins: Description of a plan for furnishing a Fluid Mirror, to be used in a Reflecting Telescope.

D. Vaughan, of Cincinnati: The Zodiacal Light, the periodical appearance of Meteors, and the point in space to which the motion in the Solar system is directed.

(2.) *Meteorology.*

W. C. Redfield: On the value of the Barometer in navigating the American Lakes.

Prof. E. Loomis, of New York: Does the Moon exert a sensible influence upon the Clouds?

——: Notice of a Hail Storm, which passed over New York, July 1, 1953.

J. H. Coffin, of Easton, Pa.: An investigation of the Storm Curve, deduced from the Relations existing between the direction of the Wind, and the Rise and Fall of the Barometer.

Lorin Blodget, of Washington: On the Barometric Pressure in extreme Latitudes, and the existence of Belts of low Barometer in the Arctic Regions.

——: On the South East Monsoon of Texas, the Northers of Texas and the Gulph of Mexico, and the abnormal Atmospheric Movements of the North American Continent generally.

—— On the distribution of Heat over the North American Continent, and the construction of its Isothermal Lines.

—— On the Subordination of Atmospheric Phenomena, or the Position of the several Classes with respect to the primary Cause or Initiatory Processes.

—— On the distribution of precipitation in Rain and Snow on the North American Continent

Prof. A. D. Bache, Supt. U. S. Coast Survey, Washington: On the Winds of the Coast of the United States on the Gulf of Mexico.

Prof. Joseph Lovering, Cambridge: On Optical Meteorology.

(3.) *Geology, Geography, Chemistry.*

Prof. J. M. Safford, of Lebanon, Tenn.: On the parallelism of the lower Silurian groups of Middle Tennessee with those of New York.

W. C. Redfield, of New York: On the Geological Age and Affinities of the Fossil Fishes which belong to the sandstone formations of Connecticut, New Jersey, and the coal-field near Richmond, Virginia.

A. Winchell, of Eutaw, Alabama: On the Geology of the Choctaw Bluff.

Dr. J. A. Warder, of Cincinnati: A Geological Reconnoisance of the Arkansas River.

J. S. Newberry, M. D., of Cleveland: On the Structure and Affinities of certain Fossil Plants of the Carboniferous era.

—— On the Carboniferous Flora of Ohio, with descriptions of fifty new Species of Fossil Plants

—— On the Fossil Fishes of the Cliff Limestone of Ohio.

Prof J. Brainard, of Cleveland: Origin of Quartz Pebbles in the Sandstone Conglomerate, and the Formation of the Silicious Stratified Rocks.

L F. Pourtales, Ass't in Coast Survey. Presented by Prof. Bache Superintendent: Notes on the Specimens of the bottom of the Ocean, brought up in recent explorations of the Gulf Stream, in connection with the Coast Survey.

Prof. Bache, Supt: Recent Discovery of a Deep-sea Bank on the eastern side of the Gulf Stream, off the Coast of South Carolina, Geor-

gia, and Florida, by Lieuts. Commanding Craven and Moffit, U. S. N. Assistants of Coast Survey.

Dr. F. A. Genth and Dr. W. Gibbs: On a remarkable class of conjunct bases containing Cobalt and the Elements of Ammonia.

Prof. E. N. Horsford: On the Solidification of the Coral reefs of Florida and the source of Carbonate of lime in the growth of corals.

Dr. W. I. Burnett, of Boston: On the Blood Corpuscle—holding Cells, and their relation to the Spleen.

——— On the Formation and Mode of Development of the Renal Organs in Vertebrata.

——— On the Formation and Functions of the Allantois.

——— Researches on the Development of the Viviparous Aphides.

——— On the Reproduction of the Toad and Frog, without the intermediate stage of Tadpole.

——— On the Signification of Cell Segmentation.

Prof. J. Riddell, New Orleans: On the Histology of Red Blood.

——— On the Origin of Capillary Blood Vessels.

——— On the Structure and Transformation of Oscillaria aureliana.

——— S. N. Sanford, of Granville, Ohio: On some points in the History of Gordius.

R. Howell, of Nichols, New York: On the Wheat Fly, and its Ravages.

Prof. Alphonso Wood, of Cincinnati: On Six New Species of Plants.

(5.) *Miscellaneous.*

Prof. E. Loomis, of New York: On the Measurement of Heights by the Barometer.

Prof John Brocklesby, of Trinity College, Hartford: On the Rising of Water in the Springs immediately before Rain.

W. H. B. Thomas, of Cincinnati: Indications of Weather, as shown by Animals and Plants.

Prof. E. N. Horsford, of Cambridge, Mass.: On the fatal effects of Chloroform.

Prof. S. S. Haldeman, of Columbia, Pa.: Investigation of the power of Greek Z, by means of Phonetic Laws.

Loren Blodgett, of Washington: On the Earthquake of April 29, '52.

Lt. E. B. Hunt: Remarks on Lithography and Lithographic Transfers.

——— Project of a Geographical Department of the Library of Congress.

Prof J. L. Riddel, New Orleans: On the Binocular Microscope.

Capt. Wilkes: Account of Experiments on Sound.

——— Notice of Bradford's Machine for separating metals by their specific gravity.

Andrew Brown, of Natchez, Miss.: On the effect of the Reclamation of the annually inundated Lands of the Mississippi Valley, upon the general Health of the country, and the navigation of that River.

Rev. P. R. Lynch, of Charlston: The Artesian Well, Charlston.

Herman Haupt, Supt. of the Pennsylvania Central Railroad, Philad: On the resistance of the Vertical Plates of Tubular Bridges.—*Sil. Jour.*

The Comet.—Mr. J. R. Hind, in a letter to the London *Times*, gives the following particulars respecting the Comet:—"The comet which has been so conspicuous during the last week, was very favourably seen here on Saturday, and again on Sunday evening On the latter occasion, allowing for the proximity of the comet to the horizon, and the strong glow of twilight, its nucleus was fully as bright as an average star of the first magnitude; the tail extended about 3 degrees from the head. When viewed in the comet seeker the nucleus appeared of a bright gold colour, and about half the diameter of the planet Jupiter, which was shining at the same time in the southern heavens, and could be readily compared with the comet. The tail proceeds directly from the head in a single stream, and not as sometimes remarked, in two branches. The distance of this body from the earth at 8 o'clock last evening, was 80,000,000 miles; and hence its results, that the actual diameter of the bright nucleus was 8000 miles, or about equal to that of the earth, while the tail had a real length of 4,500,000 miles, and a breadth of 250,000, which is rather over the distance separating the moon from the earth. It is usual to assume that the intensity of a comet's light varies as the reciprocal of the products of the squares of the distances from the earth and sun, but the present one has undergone a far more rapid increase of brilliancy than would result from this hypothesis. The augmentation of light will go on till the 3rd of September, and it will be worth while to look for the comet in the day time about that date: for this purpose an equatorially mounted telescope will be required, and I would suggest the addition of a light green or red glass, to take off the great glare of sunlight, the instrument being adjusted to focus on the planet Venus. This comet was discovered on the 10th of June by Mr. Klinkerfues, of the Observatory at Gottingen, but was not bright enough to be seen without a telescope, until about August 13. In a letter copied into the *Times* a few days since, Sir William hints at the possibility of this being the comet I had been expecting, but I avail myself of the present opportunity of stating that such is not the case, the elements of the orbits having no resemblance. The comet referred to will probably reappear between the years 1858 and 186 , and, if the perihelion passage takes place during the summer months, we may expect to see a body of far more imposing aspect than the one at present visible."

Railway Accidents.—The following table shows the comparative statement of casualties upon the railroads of Great Britain and New York, in proportion to the whole number of persons travelling:

	Great Britain.		*New York.*
Passengers killed	1 in 2,785,491	..	1 in 286,179
Employés killed	1 in 742,797	..	1 in 124,010
Others killed	1 in 1,392,714	..	1 in 45,929
Passengers injured	1 in 234,568	..	1 in 90,739
Employés injured	1 in 1,128,427	..	1 in 83,603
Others injured	1 in 3,301,323	..	1 in 79,155
Total killed	1 in 412,665	..	1 in 43,454
Total injured	1 in 183,406	..	1 in 28,078
Killed and injured	1 in 126,973	..	1 in 17,425

Iron Sleepers —Messrs. Day & Laylee, of Ashford, have recently taken out a patent for semi-tubular wrought and cast-iron transverse sleepers for railways. The sleepers are laid with their concave side downwards, and in those of wrought-iron an opening is left in the centre of them, for the purpose of facilitating the perfect packing of the sleeper, for passing other rails for crossings, and also for convenience of drainage In the cast-iron sleeper this is accomplished by casting it in two pieces, and connecting them by means of wrought-iron bars. Openings are left in the wrought-iron sleeper to receive the rail seating, which is of cast iron, in two pieces, a wooden key being used to tighten the rail in the usual manner. In the cast-iron sleeper, the seating or chair and the sleeper are in one casting. It is said that to each 15 ft. rail, the bearing surface of the sleepers will be 11½ ft. It is presumed that by this plan the maintenance of the permanent way will cost less than one-half that of a line where ordinary wooden sleepers are used. The ready means of packing at the two ends, and from the central opening will, it is said, save labour; and the bearing surface of the sleeper being near the top of the ballast, a less thickness will suffice. The form of the sleeper, too, it is thought, affords facility for a more perfect drainage than if it were solid; added to which the seating for the rail being 10 inches long, a greater bearing is obtained than with the ordinary chairs.—*Mining Journal.*

Improvement of Railways.—The Crystal Palace Railway from New Cross to the Exhibion is to be constructed in accordance with the plans of the Permanent Way Company, which, amongst other improvements, consists in making the rails into a continuous bar, called fish-jointing. This method is not altogether new, it having been adopted for some while, where the results were singularly convincing and economical, as shown by the various half-yearly reports of the cost of maintenance, nearly fifty per cent. of the labour being spared; and the entire absence of accidents testifying to its more vital principle of safety. To read or converse in a railway carriage was formerly a matter of difficulty, but by this system neither is any longer a task. This fact is exemplified upon the Brighton line where a little below Croydon, and before reaching the Merstham Tunnel, there is about a mile of the new line laid. We are no sooner on it than the change is most perceptible: exchanging an oscillating motion and clicking noise, for a smooth road and a monotonous sound of much less intensity, so that both conversation and reading may be indulged in with comparative ease. The invention which has wrought this comfort and security is a patent belonging to a few engineers, of great practical experience, who have enrolled themselves in an association termed the Permanent Way Company, with the view of rendering the use of this and other patents belonging to them more accessible to the public.—*Illustrated London News.*

Mauvaises Terres (Bad Lands.)—After leaving the locality on Sage Creek, and crossing that stream, and proceeding in the direction of White River, about twelve or fifteen miles, the formation of the Mauvaises Terres proper bursts into view, disclosing as here depicted, one of the most extraordinary and picturesque sights that can be found in the whole Missouri country. From the high prairies that rise in the back-ground by a series of terrrces or benches, towards the spur of the Rocky Mountains, the traveller looks down into an extensive valley, that may be said to constitute a world of its own, and which appears to have been formed partly by an extensive vertical fault, partly by the long-continued influence of the scooping action of denudation.

The width of this valley may be about thirty miles, and its whole

length about ninety, as it stretches away westwardly, towards the base of the gloomy and dark range of mountains known as the Black Hills. Its most depressed portion, three hundred feet below the general level of the surrounding country, is clothed with scanty grasses, and covered by a soil similar to that of the higher grond. To the surrounding conutry, howewer, the Mauvaises Terres present the most striking contrast. From the uniform, monotonous open prairie, the traveller suddenly descends one or two hundred feet, into a valley that looks as if it had sunk away from the surrounding world; leaving standing all over it, thousands of abrupt, irregular, prismatic, and columnar masses frequently capped with irregular pyramids, and stretching up to a height of from one to two hundred feet or more. So thickly are these natural towers studded over the surface of this extraordinary region, that the traveller threads his way through deep, confined, labyrinthine passages, not unlike the narrow, irregular streets of some quaint old town of the European continent. Viewed in the distance, indeed, these rocky piles, in their endless succession, assume the appearance of massive artificial structures, decked out with all the accessories of buttress and turret, arched doorway and clustered shaft, pinnacle and finial, and tapering spire. One might almost imagine oneself approaching some magnificent city of the dead, where the labour and the genius of forgotten nations, had left behind them a multitude of monuments of art and skill. On descending from the heights, however, and proceeding to thread this vast labyrinth, and inspect, in detail, its deep, intricate recesses, the realities of the scene soon dissipate the delusions of the distance. The castellated forms which fancy had conjured up have vanished; and around one on every side is bleak and barren desolation. Then, too, if the exploration be made in midsummer, the scorching rays of the sun pouring down in the hundred defiles that conduct the wayfarer through this pathless waste, are reflected back from the white or ash-coloured walls that rise around, unmitigated by a breath of air or the shelter of a solitary shrub. The drooping spirits of the scorched geologist are not permitted, however, to flag. The fossil treasures of the way well repay its sultriness and fatigue. At every step, objects of the highest interest present themselves.

Embedded in the debris lie strewn, in the greatest profusion, organic relics of extinct animals. All speak of a vast fresh water deposit of the early tertiary period, and disclose the former existence of most remarkable races, that roamed about in bygone ages high up in the valley of the Missouri, towards the sources of its western tributaries; where now pasture the big-horned *Ovis Montana*, the shaggy buffalo or American bison, and the elegant and slenderly constructed antelope. Every specimen as yet brought from the Bad Lands, prove to be of a species that became exterminated before the mammoth and mastodon lived, and differ in their specific character, not alone from all living animals, but also from all fossils obtained even from contemporaneous geological formations elsewhere. Along with a single existing genus, the rhinoceros, many new genera, never before known to science, have been discovered, and some, to us at this day, anomalous families, which combine in their anatomy structures now found only in different orders. They form, indeed, connecting links between different orders. For example, in one of the specimens from this strange locality, we find united characters belonging now to three orders. Another, the *Oreodon*, has grinding teeth, like the elk and deer, with canines resembling omniverous, thick-skinned animals; being, in fact, a race which live both on flesh and vegetables, and yet chewed the cud like our cloven-footed grazers!

Associated with these extinct races, we behold also, in the Mauvaises Terres, abundant remains of fossil Pachydermata, of gigantic dimensions, and allied in their anatomy to that singular family of proboscidate animals, of which the Tapir may be taken as a living type. These form a connecting link between the tapir and rhinoceros; while in the structure of their grinders, they are intermediate between the damon and rhinoceros; by their canines and incisors they connect the tapir with the horse on the one hand, and the peccary and hog on the other. They belong to the same genus of which the labors of the great Cuvier first disclosed the history, under the name of *Palaeotherium*, in publishing his description of the fossil bones exhumed from the gypsum quarries of Montmatre, near Paris, but are of distinct species; and one at least, of this genus, discovered on the Bad Lands, must have attained a larger size than any which the Paris basin afforded.

A nearly entire skeleton of this animal was discovered, which measured, as it lay imbeded, *eighteen* feet in length, and *nine* in height. Besides these various remains of singular forms of Mamminiferæ, there were also discovered many turtles, one of which was estimated to weigh a ton. These turtles were chiefly observed in a portion of the Bad Lands, some five or six miles in extent, which has much the appearance of an ancient lake. At one of these lake-like expansions, hundreds of fossil turtles were discovered.—*Ohio Statesman.*

What is Coal?—A curious case relating to a mineral, has lately occurred in Scotland, in which the opinions of many scientific men of the highest repute have been arranged against one another. The main question between the parties, however, was whether the substance was or was not coal. On the part of the plaintiffs, Professors Ansted, Anderson, Mr. Brande, the celebrated chemist, Mr. Alexander Rose, the Rev. Dr. Anderson, Dr. George Wilson, and Dr. J. T. Cooper, were examined. They decided that the mineral was not coal. On the part of the defendants, Prof. Johnson, of Durham, Prof. Ramsay, of London, Professor Hoffman, Chemist in the Government School of Mines, Professor Fyfe, Dr. Douglas Maclagan, Dr. Gregory, Professor Frankland, Mr. Dickinson Goverment Inspector of Coal Mines in England and a number of other scientific, practical and operative witnesses, were examined. The result of their evidence was, that it was a coal of the Cannel or Parrot kind, differing in no essential respect from that sort of coal, but agreeing geologically and chemically with it in all its characteristics—that its component parts were similar to those which composed coal, its ash contained the same ingredients, and its combustion agreed in character. After the jury had been addressed by most eminent counsel on both sides, the Lord President summed up. The jury were to determine whether the substance in question fell within the term whole coal in the demise, for it was not pretended that it came within any other term specified in it. On the one side there were four geologists, who gave it as their opinion that it was not coal, and five on the other side, who said it was coal, all speaking with perfect sincerity, according to what they as geologists, classed as coal. Men of the highest reputation in geology and chemistry had been examined, but they differed very much in opinion. On one side there were five of the most eminent chemists, who had applied all their skill and energy to find out whether it was coal or not, and who had expressed themselves as clearly of opinion that it was not coal, while ten equally eminent on the other side, were of a diametrically opposite opinion. Is this substance, then, a coal or not, in the ordinary language of those who deal in it, and of the country? because, to find a scientific solution of it, after what has been brought to light for the last five days would be, he said, indeed a difficult thing. The jury, after retiring for about five minutes, returned with a verdict for the defendants, thus establishing that in their opinion, the substance in question was, in effect, coal, and removing altogether from the company the slightest imputation of concealment or deceit.

Artificial Fuel Manufacture from Coal Refuse.—In the first place, the coal dust is thoroughly washed in a tank, fitted with a horizontal perforated diaphragm, beneath which it communicates with a cylinder and solid plunger, which being set in action by any prime-mover, an alternate motion is thereby given to the water, the coal-dust thoroughly washed, and all earthly matter, pyrites, schist, &c., fall to the bottom of the tank, which may be taken out by a lateral opening, and the water removed. The coal-dust is then dried, and passed between two grooved rollers, to reduce it to a uniform size. The next operation is to mix it with seven or eight per cent. of pitch in a heated state which is accomplished in a peculiarly constructed furnace. The heated vapours and products of combustion from a common furnace grate are made to pass under and through a circular chamber, in which is a revolving cast iron receptacle, with proper openings or gratings to admit the vapour, over which is a fixed rake, secured by rods and bolts. The operation may be thus described:—The prepared coal-dust is introduced into the receptacle by a properly arranged door, which, by the rotation and the rake, is uniformly spread over it. When the temperature of the coal has reached 200° Fahrenheit the valve of a pitch boiler, constructed over the furnace fire, is opened, and the liquid descends by means of a pipe into a long vessel, placed over the rake, from which it is distributed in a very uniform manner among the coal. When sufficiently impregnated and mixed, it is by an arrangement of traps and fixed scrapers allowed to fall into a receptable beneath. From thence, while still hot, it is placed in cast iron moulds, of any convenient size, for the formation of the fuel brick, and subjected to a hydrostatic pressure equal to 45,000 lbs., producing a compact and solid mass, exceedingly economical for stowage, and which may be broken up for use as required.

Pisiculture.—M. de Quatrefages has communicated to the Academy some important researches bearing on different points connected with the artificial fecundation of the eggs of fishes. Assisted by M. Millet, of whom we have spoken in our last communication, he has first shown that the temperature of the water for fecundation, is a point deserving especial attention. This temperature varies for each species, and it is well to ascertain it for each separately. In general, for the winter fish, as trout, it is between 6° and 8° C.; for the early spring fishes, as pike, 8° to 10°.; for the later spring, as perch, 14° to 16° C.; and finally, for the fishes of summer, as the barbel, 20° to 25° C. The necessity of a specific temperature is connected also with the vitality of the spermatozoids of different species, which is of short duration, it not exceeding 8 minutes in the pike, whilst in man it lasts hours. The maximum temperature for the spermatozoids of the pike has been obtained at +2° C.; a higher temperature destroys them rapidly. The spawn of the pike is kept perfectly well in ice-water, and the

spermatozoids perish only with a cold below 10° or 12°. The influence of temperature on the vitality of the spermatozoids of fishes, and therefore on the fecundation of eggs, presents a reason for the instinct which urges some fishes to ascend streams, and at times to penetrate into rivulets where they have hardly water enough for their movements. M. de Quatrefages deduces some rules which are important to the art of pisciculture, bearing especially upon the preservation of the spawn. 1. The water should not be supplied with the spawn in advance; it is well to leave the spawn in place even till the moment of employing it, and the fecundation should follow soon, upon the death of the male fish. 2. Since the fecundation should take place within a day or twelve hours after the death of the animal, the spawn should be then taken and kept separate. 3. To preserve the spawn, it should not be placed in the water, or in the open air, but better in a moist linen cloth, which is kept at a temperature equal to, or a little below that, which for each species gives the maximum duration to the movements of the spermatozoids. 4. If there are several fecundations to operate successively, it is necessary to detach for each, the quantity of spawn required, and leave the rest in some convenient place.—*Correspondence of Silliman's Journal.*

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—August, 1853.

Latitude 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21 *min. West. Elevation above Lake Ontario :* 108 *feet.*

Magnet.	Day.	Barom. at tem. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of the air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	M'N V	Rain in Inch.	S'nw in Inch.
						°	°	°	°												Miles		
b	1	29.652	29 607	29.598	29.619	65 6	68.6	69.5	68.37	0.545	0.636	0 600	0.593	88	94	86	88	W	E N E	N E	1.27	0.280	- -
b	2	624	.617	.588	.605	64.2	75.4	61.7	67.43	.542	.589	.395	.524	93	69	74	80	N	S S E	Calm	3.15	- -	- -
a	3	.551	.505	.447	.491	63.7	73 1	67 3	63 52	.505	.587	.460	.533	88	74	71	79	Calm	E N E	E N E	3 17	- -	-
	4	.419	.417	.450	.426	66.2	79 2	65.0	71.40	.539	.559	.496	.531	86	58	82	72	N b E	S b W	N E b N	4.37	- -	-
	5	.507	.486	.474	.493	66.7	82 0	64 2	72.32	.477	.593	.435	.516	75	57	83	68	N b E	S	Calm	1.07	- -	- -
	6	.566	.558	.576	.570	65 6	79.3	65.0	70.62	.577	.707	.559	.617	94	73	93	85	Calm	S E b E	S	2.78	- -	- -
	7	.629	.609			67.1	83.6			.550	.608			86	54			S	S b E		3.77	0.150	- -
c	8	.669	.644	.629	.652	64.7	81.5	70 0	72 93	.562	.635	.535	.554	94	60	75	71	Calm	S b E	N N E	2.87	- -	- -
b	9	.641	.652	.662	.655	64·7	80.0	72.7	73.02	.486	.735	.662	.650	81	74	85	82	Calm	S E b S	S W b S	1.83	Inap	-
b	10	.699	.657	.677	.674	66 5	88 4	71.6	76 98	.596	.640	.631	.630	94	50	84	73	Calm	S	Calm	4 66	- -	-
c	11	.716	.675	.627	.671	68.1	91.4	75 6	79.25	.549	.688	.685	.647	83	48	80	69	Calm	S	Calm	4 73	- -	- -
	12	.672	.557	.562	.593	71.7	87.9	77 4	79.83	.657	.862	.780	.757	87	67	85	77	Calm	S	N b W	4.34	0.215	- -
	13	.564	.460	.444	.486	73 6	90 8	72.0	78.53	.744	.874	.626	.741	94	63	82	79	Calm	S E	Calm	3 06	0.245	- -
b	14	.416	.440			74.0	83 0			.716	.752			88	69			Calm	N		4 63	- -	- -
b	15	.649	.651	.632	.641	66.8	82.2	69.6	73.38	.492	.576	.510	.544	76	54	72	68	N b E	E b N	E b N	4.48	- -	- -
	16	.651	.623	.578	.612	63.6	84.5	71.1	75.30	.445	.540	.691	.589	78	47	94	72	N N E	E S E	N N E	3.39	- -	-
	17	.546	.415	.354	.427	66.6	85.1	67 1	73.77	.527	.656	.593	.601	83	55	92	76	N N E	S E b S	N b E	3.83	0.460	- -
	18	.302	.336	.511	.396	64.9	62.2	55.6	59.77	.536	.447	.294	.403	89	82	67	76	Calm	N N W	N b W	7.41	0.005	- -
	19	.576	.573	.586	.582	49.6	67 9	53.8	57 32	.255	.204	.258	.245	76	31	63	56	N b W	N W	Calm	5.57	- -	- -
	20	.626	.566	.525	.571	48 7	70 7	60.5	60.97	.256	.367	.352	.323	76	50	68	62	Calm	S	N W	5 28	- -	- -
	21	.541	.491			47.6	75 7			243	.511			75	60			N b W	S b W		4.93	- -	- -
	22	.675	.739	.799	.751	56.1	72.9	57.1	62.93	.351	.482	.354	.403	80	61	78	72	N	S E b S	N N E	4.98	- -	- -
c	23	.832	.739	.590	.714	61.4	68.0	65.7	65.22	.408	.402	562	.460	77	60	92	76	S E b E	E	N E	6 56	1 020	- -
b	24	.384	.320	.526	.418	67.7	80.0	61.4	69.07	.619	.592	.365	.503	94	59	68	76	S b E	W N W	N W b W	7.55	Inap	- -
c	25	.681	.739	.750	.732	48 4	65 7	52 0	56.65	.237	.401	.332	.32[illegible]	70	66	87	73	N W b W	S E b S	S E b E	5.20	- -	- -
d	26	.753	.632	.476	607	48.5	70 7	70.3	65·92	.246	.505	.688	.479	73	69	80	74	N N E	E	S S E	5 17	0.200	- -
b	27	.442	.534	.719	.588	64 4	62.2	55 6	60.50	.549	.322	·310	.382	94	59	71	73	W	W	W b N	9.50	- -	- -
b	28	.850	.827			50 6	66.4			.291	.440			81	70			N W	S		3 48	- -	- -
b	29	.800	.725	.722	.713	49 4	71.6	60.0	61.25	.297	.395	·366	.378	85	53	71	69	Calm	S b W	Calm	2.58	Inap	- -
b	30	.670	.568	.508	.569	57.5	70 5	70 4	65 80	.301	.433	.440	.42[illegible]	65	60	60	68	Calm	S W b S	Calm	2 04	Inap	- -
a	31	.621	.633	.710	.661	64 3	70 8	61.8	65 42	.492	.553	.466	.488	84	69	87	81	N b E	E S E	S E b E	3 33	- -	- -
	M	29 611	29 579	29.588	29 591	62.19	76 39	65.33	68 61	0 474	0.553	0.496	0.513	84	62	78	74	Ml's 2.52	Ml's 7 63	Ml's 2 83	4 23	2 575	-

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
972.76	746 25	1212.66	879.16

Mean direction of the wind S. E. by S.
Mean velocity of the wind - - 4 23 miles per hour.
Maximum velocity - - - - - 18 5 miles per hour, from 4 to 5 p.m. on 18th
Most windy day - - - - - 27th: Mean velocity, 9 50 miles per hour.
Least windy day - - - - - 5th Mean velocity, 1.07 ditto.
Raining 19 3 hours.

The column headed "Magnet" is an attempt to distinguish the character of each day, as regards the frequency or extent of the fluctuations of the Magnetic declination, indicated by the self-registering instruments at Toronto. The classification is, to some extent, arbitrary, and may require future modification, but has been found tolerably definite as far as applied. It is as follows:—

(*a*) A marked absence of Magnetical disturbance.
(*b*) Unimportant movements, not to be called disturbance.
(*c*) Marked disturbance—whether shewn by frequency or amount of deviation from the normal curve—but of no great importance.
(*d*) A greater degree of disturbance—but not of long continuance.
(*e*) Considerable disturbance—lasting more or less the whole day.
(*f*) A Magnetical disturbance of the first class.

The day is reckoned from noon to noon. If two letters are placed, the first applies to the earlier, the latter to the later part of the trace. Although the Declination is particularly referred to, it rarely happens that the same terms are not applicable to the changes of the Horizontal Force also.

Highest Barometer - - 29 850, at 6 A. M., on 28th. } Monthly range:
Lowest Barometer - - 29 300, at 8 A.M., on 18th. } 0.550 inches.
Highest regist'd Temp. - 91 9, at — P.M., on 11th } Monthly range:
Lowest regist'd Temp. - 42 5, at — A.M., on 25th } 52.4
Mean Maximum Temperature - - - - 78 50 } Mean daily range:
Mean Minimum Thermometer - - - - - 57 10 } 21.41
Greatest daily range - - - - - 39.1 from P. M. 24th to A. M. of 25th.
Warmest day - - 12th - - - Mean Temperature - 79.83 } Difference
Coldest day - - - 25th - - - Mean Temperature - 56 65 } 23.18

The "Means" are derived from six observations daily, viz., at 6 and 8 A. M., and 2, 4, 10 and 12, P. M.

Possible to see Aurora on 23 nights.
Aurora seen on 3 nights.

Comparative Table for August.

Year.	Temperature Mean.	Max. obs'rvd	Min. obs'rvd	Range.	Rain. D'ys	Inches.	Snow. Dy's	Inch.	Wind Mean Velocity
	°	°	°	°					Miles.
1840	64.6	f80.1	47.4	32 7	12	2 905	0	--	--
1841	64.4	83.5	46.7	36.8	9	6 170	0	--	--
1842	65 7	80.7	45.3	35 4	6	2 500	0	--	--
1843	66.4	85 5	44 4	41 1	4	4.850	0	--	0.12 lb
1844	64.3	82 5	44.3	38 2	17	imperfect	0	--	0 16
1845	67.9	82 5	44.4	38 1	9	1 725	0	--	0.19
1846	68.4	86.3	50.4	35 9	9	1.770	0	--	0.17
1847	65.1	83.1	44.9	38.2	10	2 140	0	--	0.19
1848	69 2	87.5	49.3	38.2	8	0 855	0	--	4 55
1849	66.3	79.5	51.4	28.1	10	4.970	0	--	3.76
1850	66.8	84.2	43.0	41.2	13	4 355	0	--	4 46
1851	63 6	79.8	43 6	36 2	10	1.360	0	--	4 62
1852	65.9	81.2	46 7	34.5	9	2 695	0	--	3 30
1853	68.6	91.6	47 6	44.0	11	2.575	0	--	4 23 m
Mean	66 23	83.43	46.39	37.04	9.8	2 990	0		0.17 lb 4.15 M's

The mean temperature of the month is 2.4 above the average of 14 years, and is with one exception (1848) the highest known: the maximum thermometer recorded 94.9 on the 11th, which is the highest that has ever occurred at the Observatory, but the warmest day on the whole was the day following this, which was 13.5 above the normal. From the 9th to the 17th inclusive, the differences above the normal were as follows: 6.5, 10.5, 12.8, 13 5, 12 3,—7,—2, 9.3, 7.8; these were succeeded by three cold days, the remainder of the month being of an average character.

The blanks in the Magnetic column arise from the failure of the Photographic traces from the use of improper paper, the stock of proper paper being exhausted and some delay having occurred in the arrival of a supply from England.

Monthly Meteorological Register, St. Martin, at Isle Jesus, Canada East, August, 1853.

Nine Miles West of Montreal.

[BY CHARLES SMALLWOOD, M. D.]

*Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 ft.**

Day.	Barom: corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapour.			Humi'y of the Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Weather, &c. A cloudy sky is represented by 10; a cloudless sky by 0.		
	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2. P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.		6 A. M.	2 P. M.	10 P. M.
1	29.913	29.818	29.855	63.4	80.1	67.0	.488	.588	.593	.84	.58	.89	N E	N E	N W b W	Calm.	0.67	0.22	Inap.	Clear.	Cum. Str. 10	Slight Rain.
2	.882	.818	.887	65.1	86.2	67.0	.555	.787	.570	.89	.65	.81	N	E N E	W N W	Calm.	Calm.	2.50		Str. 10.	Clear.	Clear.
3	.814	.686	.686	70.2	86.9	68.0	.568	.617	.613	.78	.50	.89	S W	S W	S	3 06	1.14	4.12		Clear.	Clear.	Clear.
4	.672	.474	.599	70.2	79.2	69.1	.659	.628	.601	.90	.64	.85	N E b N	N E b E	S W b S	Calm.	0.87	0.03		Cum Str. 4.	Cir. Str. 4.	Clear.
5	.695	.664	.697	68.5	80.0	66.3	.496	.648	.516	.72	.64	.80	N E b E	S E	N E	1 81	Calm.	5.00		Clear.	Clear.	Clear.
6	.798	.786	.788	65.7	72.2	67.0	.473	.638	.626	.76	.82	.94	N E	S S W	E N E	5 25	4 16	0.49	Inap	Clear.	T S. at 11. 40 a.m	Clear Shooting S
7	.798	.826	.819	69.0	85.7	68.0	.634	.692	.646	.90	.58	.91	W	S W	S b W	5 00	2.16	1.28	0.232	Shower at 5 A. M.	Show'r at 2 P. M.	C. S. Stars, F. Au.
8	.731	.645	.709	72.2	86.3	70.0	.607	.681	.597	.78	.56	.82	W S W	S	S W	0.25	2.62	2.37	Inap.	Cirr 4 shower in n.	Cum'l. 2.	Clear S. Stars.
9	.695	.709	.799	66.1	82.1	69.8	.516	.597	.634	.80	.55	.90	W	W N W	N W b W	2.90	5.25	3.32		Cum. Str. 10	Cirr Cum. Str. 4.	Clear S. Stars.
10	.798	.686	.726	70.2	92.4	73.2	.568	.638	.568	.78	.46	.71	S	S S W	S b W	Calm.	0 92	0.75		Clear.	Clear.	Clear.
11	.751	.648	.662	74.0	95.4	72 4	.648	.607	.704	.78	.44	.74	W b S	W S W	W N W	1.35	4.75	6.59	0.136	Clear.	Cir. Cum. 4.	Clear, S. at 6 p.m
12	.857	.639	.631	74.4	80.1	76.3	.751	.827	.727	.90	.82	.82	W	E b N	E N E	2 39	Calm.	1.66	0.140	Str. 10, Shw'r 6.20	Show'r 1.50 P. M.	Str. 10.
13	.627	.541	.540	70.5	86.3	77.6	.692	.751	.617	.95	.61	.67	N E b E	N b E	N E b E	4.89	3.14	2.51	0.300	Str. 6, rain N, d. t	Cirr. Cum. Str. 4.	Rain, Dis. Thun.
14	.408	.501	.502	66.7	81.0	70.6	.690	.670	.659	.96	.64	.90	N E	E	S E b E	4.93	Calm.	Calm	2.273	Rain ceased 7. 20.	Str. 5.	Clear.
15	.681	.573	.640	67.0	88.6	70.1	.593	.541	.568	.89	.42	.78	E S E	S b E	S S E	1.24	1.18	0.46		Heavy Fog.	Clear.	Clear.
16	.684	.641	.579	64.2	89.0	74.6	.565	.715	.617	.94	.53	.74	E S E	E S E	N E b N	2 50	Calm.	Calm.		Clear.	Clear.	Clear.
17	.546	.384	.350	65.8	83.0	69.0	.527	648	.601	.85	.58	.85	N N E	S E	N E b E	1 18	5.15	1.30		Cir. Str. 4.	Clear.	Cirr. Cum. 2.
18	.308	.283	.359	66.5	56.6	52.3	.605	.432	.373	.94	.94	.93	E N E	N N E	N b E	2.10	9.00	8.78	0.933	Str. 8, Rain in N't.	Rain b. at 1.40 p.m.	Str. 10.
19	.449	.413	.449	53.1	66.1	54.8	.274	.516	.349	.66	.80	.81	N	W N W	W N W	6.60	6 75	7 79		Clear.	Cum'l. 2.	Cuml. 2.
20	.501	.462	.454	56.0	67.5	58.0	.363	.431	.421	.79	.65	.86	W N W	W b N	S b W	1.12	2 05	4.25		Clear.	Cuml. Str. 8.	Clear.
21	.452	.385	.460	60 7	75.0	59.6	.416	.450	.478	.79	.52	.94	W S W	W S W	W b N	3 99	6.00	4.98		Clear.	Cuml. St 4.	Rain C. at 7.10 p.m
22	.603	.641	.712	54.0	67.9	53.8	.382	.531	.361	.89	.81	.87	N W b N	N W b N	N W b W	0.41	Calm.	0.15	0.373	Cirr. Str. 2.	Cuml. Str. 7.	Clear.
23	.796	.702	.634	54 2	75.1	57 3	.326	.428	.398	.76	.50	.84	N E b N	S E	E b S	Calm.	1.01	Calm.		Clear.	Light Cirr. 3.	Clear.
24	.492	.319	.264	60.2	60.0	62.5	.467	.480	.559	.89	.90	.99	S E b S	S E b S	S b W	1.55	9.88	7.62	1.280	Cirr. Cum. 3	Rain at 10.20. a. m.	Ceased at 7.50 p.m
25	.287	.629	.675	53.7	72 2	54.2	.386	.578	.349	.93	.74	.81	S W	S W	S W	4.32	7.62	Calm.		Str. 2.	Cir. 2	Clear Ft. Au. Str.
26	.779	.670	.561	48 1	73.8	63.0	.302	.442	.461	.86	.55	.99	E b S	S E b S	S E b E	Calm.	1.15	2.22		Clear.	Light Cirr. 3.	Cirr. Cum. Str. 9.
27	.315	.300	.444	67.0	75.7	58.1	.534	.607	.412	.81	.71	.84	S b E	S S W	W	17.56	9.12	10.43	1.286	Rain 7. 40.	Ceased at 11.20.	Str. 4.
28	.452	.573	.582	54.0	67.1	56.7	.304	.455	.385	.70	.69	.84	N W b W	N W b W	W b S	7 10	5.62	4.75		Cum. 2.	Clear.	Clear
29	.613	.528	.551	56.6	76.0	65.7	.408	.541	.449	.89	.61	.72	W b S	W b S	W S W	1.93	7.45	5 37		Cum. Str. 2.	Clear.	Clear, Comet still v
30	.580	.450	.418	60 2	81.3	68.0	.441	578	.496	.84	.55	.72	W S W	W b S	W S W	3 30	4.34	2.82		Clear.	Clear.	Rain at 9 p. m.
31	.411	.448	.518	62.8	79 8	62.9	.547	.628	.499	.96	.64	.89	E N E	W S W	W	0.79	2 51	1.20		Cir. Str. 8.	Clear.	Clear.

Barometer.
- Highest, the 1st day 29.913
- Lowest, the 24th day 29.264
- Monthly Mean 29.598
- " Range 0.649

Thermometer
- Highest, the 11th day . . . . . 96°2
- Lowest, the 26th day . . . . . 43.°3
- Monthly Mean . . . . . 68.°61
- " Range . . . . . 42.°9?

Greatest Intensity of the Sun's Rays—143.°6.

Mean of Humidity—.741.

Lowest point of Terrestial Radiation 37.°1.

Amount of Evaporation—3.16 inches.

Rain fell in 13 days amounting to 7.089 inches, and was accompanied thunder and Lightning on three days.

Most Prevalent wind—S. W.

Least do. do. E.

Most Windy Day—the 27th day, mean—12.37 miles per hour

Least Windy Day—22d, mean—0.18 miles per hour.

Aurora Borealis visible on 3 nights, and might have been seen on 22 nights.

Shooting Stars very numerous on the nights of 7th, 8th, 9th, 10th, & 13th

Comet first seen here on the 22d day, in N.W., 8 p.m., in constellation Leo. 27th, Comet visible, tail 15° long. On the 29th, at 7.30: its R. A. was 11 h. 40 m. 10 s., and dec. N. 15° 0′ 22″.

The electrical state of the atmosphere *generally* has indicated rather feeble intensity of Positive Electricity, and during the thunder storms, was of a negative character.

The Canadian Journal.

TORONTO, OCTOBER, 1853.

Twenty-Third Meeting of the British Association for the Advancement of Science. Hull, Sept. 7, 1853.

GENERAL MEETING.

The first General Meeting was held in the Saloon of the Mechanics' Institute, at eight o'clock in the evening: when Colonel Sabine took the chair,—but only for the purpose of resigning it to his successor. This he did in the following words:—"In addressing you for the last time from this chair, in which your kindness has been pleased to place me, I have yet one duty to perform,—and it is one which is extremely agreeable. It is to introduce to you a gentleman who by the General Committee has been selected as my successor. It has been considered necessary by gentlemen who have preceded me on several occasions to dwell on the qualifications and on the merits of the gentleman selected; but in this case Mr. Hopkins is so eminently distinguished, his accomplishments in the various branches of science, his general courtesy and amiability, and his kind disposition, have been so long and so universally appreciated, that I feel confident I shall take the course which is most agreeable to your wishes in introducing him to you in the fewest possible words. I will, therefore, with your permission, request Mr. Hopkins to take the chair to which the General Committee has so worthily elected him."

The President for the year then took the chair, and delivered the following inaugural Address on the objects and proceedings of the Association :—

The President's Address.

Gentlemen of the British Association,—Before I proceed to those remarks which I may have to address to you on matters of science, let me avail myself of this opportunity of expressing to you the sense I entertain of the honour which you have conferred upon me in electing me to the Presidency of this Association. When the high office was first proposed to me, I could not but feel the importance of the duties attached to it. I felt, also, that there must be others who had higher claims to the honour than myself. But I was aware how frequently difficulties will occur in the immediate appointment to such offices of the persons most competent to fill them; and after having been invited to the office by those best qualified to decide such points, I conceived it right not to shrink from its responsibilities, but at once to accept it, with the determination of performing the duties it might impose upon me to the best of my ability. I have had the less hesitation in adopting this course from the knowledge of the effective and ready assistance which I should always receive, not only from our excellent Secretary, Mr. Phillips, but also from my predecessor in this chair, who is so intimately acquainted with the whole working of the association, to which he has rendered so long and so cheerfully such invaluable services. After thanking you, gentlemen, as I do most sincerely, for the high compliment you have paid me, and assuring you of my best efforts in the cause of the Association, I proceed to lay before you such statements and remarks on scientific subjects as have presented themselves to my own mind for this occasion. In doing this, I cannot but regret my inability to do justice to many subjects which might be interesting to you; and indeed, the limited time for which I should be justified in demanding your attention to an oral communication, will oblige me to omit this evening several even of those points which I was prepared to bring under your notice.

Astronomical science still continues to prove to us how much more populous is that portion of space occupied by the solar system than was suspected only a few years ago. Between the 23rd of June, 1852, and the 6th of May, 1853, nine new planets were discovered, of which seven were fonnd since the last meeting of the association. Of these nine planets, our countryman, Mr. Hind, has discovered four. The number now known, exclusive of the large planets, but including the four old asteroids, amounts to twenty-six; nor have we any reason to suppose that we have yet approximated to the whole number of these minor planetary bodies. All those which have been recently recognized appear like stars of magnitude not lower than the eighth or ninth, and are consequently invisible to the naked eye. The search for them has now assumed, to a considerable extent, a more systematic form, by a previous mapping of the stars up to a certain magnitude, and contained in a belt of a few degrees in breadth on either side of the ecliptic. Any small planet will in the first instance be inserted in the map as a small star, but will on the re-examination of the same area some time afterwards, be recognized in its true character, from the fact of its having moved from the place in which it was first observed. This mapping of the ecliptic stars from the eighth to higher magnitudes, is still comparatively limited; nor has the length of time during which any one portion, perhaps, of the space which has been thus mapped, been sufficiently great to ensure the passage through it, within that time, of any planet whose period is as long as the possible periods of those which may yet remain unknown to us. Analogy would therefore lead us to conclude in favour of the probability of their number being much greater than that at present recognized. All those which are now known lie between the orbits of Mars and Jupiter, but many may exist more distant, and of much smaller apparent magnitudes, and thus almost the same careful telescopic research may be necessary to make us acquainted with some of our planetary neighbours as with the remoter regions of space. Nor is the telescopic mode the only one by which we may detect the existence of remoter planets; for as Uranus betrayed the existence of Neptune, so may the latter hereafter reveal to us the retreats in which some more distant member of the system has hitherto hidden himself from the observation of man.

There would seem to be a tendency in the human mind to repose on the contemplation of any great truth after its first establishment. Thus, after the undisputed reception of the theory of gravitation, and the complete explanation which it afforded of the planetary motions, men seemed to think little of any further revelations which the solar system might still have to make to us respecting its constitution, or the physical causes which it calls into operation. The recent discovery, however, of so many planets, shows how imperfectly we may yet be acquainted with the planetary part of the system; and the continual discovery of new comets seems to indicate that in this department still more remains to be done. These curious bodies, too, may possibly have to reveal to us facts more interesting than any which the planets may still have in reserve for us. The experience of these latter bodies, if I may so speak, is more limited, and their testimony, consequently, more restricted. But they have already told us a noble tale. In moving, as they do, in exact obedience to the law of gravitation, and thus establishing that law, they have affirmed the highest generalization in physical science which it has been accorded to the human mind to conceive. At the same time, the approximate circularity of their orbits prevents their passing through those varied conditions to which comets are

subjected. Thus, while the latter obey, in common with the planets, the laws of gravitation, they frequently present to us, in their apparent changes of volume, form and general character, phenomena, the explanation of which has hitherto baffled the ingenuity of astronomers. One of the most curious of these phenomena has been recently observed in Biela's comet. This comet has a period of about six years and a half, and has been observed a considerable number of times on its periodical return to the neighbourhood of the sun. It appeared in November, 1845, and in the following January, the phenomenon alluded to was observed for the first time. The comet had become divided into two distinct parts with separate nuclei. Sometimes the one and sometimes the other appeared the brighter, till their final disappearance. The elements of the orbits of these twin comets were calulated by Professor Plantamour, from observations made at Geneva in 1845-6, assuming them to be uninfluenced by each other's attractions. The correctness of these elements could be determined only on the next return of the comet, which took place in the autumn of last year, one of the nuclei having been first seen by Signor Secchi at Rome, on the 25th of August, and the other on the 15th of September. The subsequent observations made upon them show that the elements of the orbits, as previously calculated from the Geneva observations, were far from exact. A complete discussion of all the observations which have been made on these comets during their last and previous appearances, is now in progress by Professor Hubbard, of the Washington Observatory. The distance between the two nuclei was much increased on their last appearance. Judging from the apparent absence of all influence and sympathy between these bodies, it would seem that their physical divorcement, though without known precedent, is final and complete.

Stellar Astronomy continues to manifest a vigour and activity worthy of the lofty interest which attaches to it. Bessel had made a survey of all stars to those of the ninth magnitude inclusive, in a zone lying between 45° of north, and 15° of south declination. Argelander has extended this zone from 80° of north, to 31° of south declination. It comprises more than 100,000 stars. Last year was published also the long-expected work of M. F. G. W. Struve, containing a catalogue of stars observed by him at Dorpat, in the years 1822—43. They are principally double and multiple stars, which had been previously micrometrically observed by the same distinguished astronomer. Their number amounts to 2874; the epoch of reduction is 1830. The introduction contains the discussion of various important points in stellar astronomy.

Notices have been brought before us from time to time, of the nebulæ observed through Lord Rosse's telescope. This noble instrument, so unrivalled for observations of this kind, continues to be applied to the same purpose, and to add yearly to our knowledge of the remotest regions of space into which the eye of man has been able to penetrate. Almost every new observation appears to confirm the fact of that curious tendency to a spiral arrangement in these nebulous masses of which mention has so frequently been made. To those persons, however, who have neither seen the objects themselves, nor careful drawings of them, a mere verbal description must convey very indistinct conceptions of the spiral forms which they assume. I have, therefore had the drawings made which are suspended in the room for your inspection. They will convey to you at once an idea of the spiral forms alluded to. I am indebted to the kindness of Lord Rosse for the use of the original drawings,—and for these large and accurate copies of them, to our excellent Secretary, Mr. Phillips, who, with his usual activity in the cause of the Association, has had them prepared for the purpose of this evening. Most of them are representations of nebulæ which have been very recently observed.

Two pairs of these are respectively drawings of the same objects; the larger one of each pair representing the nebula as seen through the large telescope, the other as seen through a smaller one of Lord Rosse's, of only three feet aperture. You will observe how little resemblance there is between them, except in the external boundary, and how entirely the characteristic details of the larger drawings are lost in the smaller ones; and if I had exhibited to you drawings of some others of these nebulæ, as seen by previous observers with inferior telescopic power, it would have been still more obvious to you how necessary are telescopes with large and perfectly ground mirrors for the development of the real character of these astonishing and enigmatical aggregations of stars.

It is for this reason that it has been thought desirable to have the nebulæ of the southern hemisphere examined with higher telescopic power than has hitherto been brought to bear upon them. You are aware with what a noble devotion to science Sir J. Herschel spent several years at the Cape of Good Hope, in the examination of the southern heavens; but his telescopic power was limited to that of a reflector of 18½ inches aperture. It is now proposed to send out to some convenient station in the southern hemisphere a reflecting telescope, with a mirror of four feet aperture. Mr. Grubb, of Dublin, has undertaken to construct such an instrument, (should the plan proposed be adopted,) under the general superintendence of Lord Rosse, Dr. Robinson, Mr. Lassel, and one or two other gentlemen. The general construction of the instrument, and the best mode of mounting it, have been decided on with careful deliberation, after consulting all the best authorities on the subject.

These important preliminaries being agreed upon, and an estimate of the whole expense of the instrument having been made by Mr. Grubb, the deputation appointed proceeded to wait on Lord Aberdeen, to ascertain whether the Government were willing to bear the expense which the plan proposed would involve. His Lordship expressed himself, without hesitation, as favourable to the undertaking; but said that, since it involved a grant of money, it would be necessary to consult the Chancellor of the Exchequer, who, supposing him to take a favourable view of the subject, would probably bring it before the House of Commons among the estimates of the ensuing year. With this answer, the deputation could not be otherwise than perfectly satisfied, nor could they fail also to be gratified by the perfect courtesy with which they were received. Judging from all we know respecting Mr. Gladstone's enlightened views on subjects of this nature, and the favourable manner in which the House of Commons has always received propositions for the advancement of science, we have, I think, every reason to hope that my successor in this chair may have the satisfaction of announcing to you another example of the liberality of the Goverment in their acceptance of the plan proposed to them. In such case, the result, I doubt not, will afford a new proof that the association is doing effectively what it professes to do as an association for the advancement of science.

The refinement of modern methods of astronomical observation has become so great, that astronomers appear very generally to think that a higher degree of refinement in the calculations of physical astronomy than has yet been attained is becoming necessary. Mr. Adams has been engaged in some researches of this kind. He has corrected an error in Burckhardt's value of the moon's parallax; and he has also determined to a nearer approximation than that obtained by Laplace the secular variation in the moon's mean motion. The former investigation is published in an appendix to the Nautical Almanac for 1856; the latter has been very recently presented to the Royal Society.

Before I quit this subject, I may state, that an American 'Ephemeris and Nautical Almanac for 1855' has been published this

year. It is the first American nautical almanac and is considered to reflect great credit on the astronomers of that country. It is under the superintendence of Lieut. C. H. Davis, assisted in the physical department by professor Pierce.

No one has contributed more to the knowledge of Terrestial Magnetism, during the last few years, than my distinguished predecessor in this chair. Formerly we owed theories on this subject much more to the boldness of ignorance than to the just confidence of knowledge, but from the commencement of the systematic observations which Col. Sabine has been so active in promoting, this vague and useless theorizing ceased,—to be succeeded, probably ere long, by the sound speculative theories of those who may be capable of grappling with the real difficulties of the subject, when the true laws of the phenomena shall have been determined. Those laws are springing forth with beautiful precision from the reductions which Colonel Sabine is now making of the numerous observations taken at the different magnetic stations. In his address of last year, he stated to us that the secular change of the magnetic forces were confirmed by these recent observations,—and also that periodical variations depending on the solar day, and on the time of the year had been distinctly made out, indicating the sun as the cause of these variations. During the present year the results of the reduction of the observations made at Toronto, have brought out, with equal perspicuity, a variation in the direction of the magnetic needle going through all its changes exactly in each lunar day. These results with reference to the sun prove, as Colonel Sabine has remarked, the immediate and direct exercise of a magnetic influence emanating from that luminary; and the additional results now obtained establish the same conclusion with regard to the influence of the moon. It would seem, therefore, that some of the curious phenomena of magnetism which have hitherto been regarded as strictly terrestrial, are really due to solar and lunar, as much as to terrestrial magnetism. It is beautiful to trace with such precision these delicate influences of bodies so distant, producing phenomena scarcely less striking either to the imagination or to the philosophic mind than more obvious phenomena which originate in the great luminary of our system.

New views which have recently sprung up respecting the nature of heat have been mentioned, though not in detail, by my two immediate predecessors in the chair of the Association. They are highly interesting theoretically, and important in their practical application, inasmuch as they modify in a considerable degree the theory of the steam-engine, the air-engine, or any other in which the motive power is derived immediately from heat; and it is correct theory alone which can point out to the practical engineer the degree of perfection at which he may aim in the construction of such machines, and which can enable him to compare accurately their merits when the best construction is arrived at.

A theory which proposes to explain the thermal agency by which motive power is produced, and to determine the numerical relations between the *quantity* of heat and the *quantity* of mechanical effect produced by it, may be termed a *dynamical theory of heat.* Carnot was the first to give to such a theory a mathematical form. His theory rested on two propositions which were regarded as axiomatic. The first embodied the abstract conception of a perfect thermo-dynamic engine, and has been equally adopted by the advocate of the new theory of heat.—Again, suppose a given quantity of heat to enter a body by any process, and thereby to change its temperature and general physical state, and then, by a second process, suppose the body to be restored exactly to its primitive temperature and condition,—Carnot's second fundamental proposition asserts that the quantity of heat which passes out of the body into surrounding space, or into other bodies, *in the form of heat*, during the second operation, is precisely the same as that which passed into the body during the first operation. This view does not recognize the possibility of heat being lost by conversion into something else,—and in this particular it is at variance with the new theory, which asserts that heat may be lost by conversion into *mechanical effect.* To elucidate this distinction, suppose a quantity of water to be poured into an empty vessel. It might then be asserted that, in emptying the vessel again, we must pour ont just as much water as we had previously poured in. This would equivalent to Carnot's proposition with respect to heat. But suppose a part of the water while in the vessel to be converted into *vapour;* then it would not be true that in emptying the vessel the same quantity of water in the form of water, must pass out of the vessel as had before passed into it, since a portion would have passed out in the form of vapour. This is analagous to the assertion of the new theory with regard to heat,—which may be lost according to that theory, by conversion into mechanical effect, in a manner analagous to that in which water may be said to be lost by conversion into vapour. But the new theory not only asserts generally the convertibility of heat into mechanical effect, and the converse,—but also more definitely, that, whatever be the mode of converting the one into the other—and whether the heat be employed to produce mechanical effect, or mechanical force be employed to produce heat,—the same quantity of the one is always the equivalent of the same quantity of the other. The proposition can only be established by experiment, Rumford, who was one of the first to adopt the fundamental notion of this theory as regards the nature of heat, made a rough attempt to determine the relation between the force producing friction and the heat generated by it; but it was reserved for Mr. Joule to lay the true foundation of this theory by a series of experiments which, in the philosophical discernment with which they were conceived and the ingenuity with which they were executed, have not often, perhaps been surpassed. In whatever way he employed mechanical force to produce heat, he found, approximately, the same quantity of heat produced by the same amount of force; the force being estimated in *foot-pounds* according to the usual mode in practical mechanics,—*i, e,* by the motive power employed in raising a weight of 1 ℔, through the space of 1 foot. The conclusion adopted by Mr. Joule is, that 1 ° Fahr. is equivalent to 772 *foot-pounds.*

These results are unquestionably among the most curious and interesting of those which experimental research has recently brought before us. When first announced some ten or twelve years ago, they did not attract the attention which they deserved; but more recently their importance has been fully recognized by all those who cultivate the department of science to which they belong. Of this Mr. Joule received last year one of the most gratifying proofs, in the award made to him by the Council of the Royal Society of one of the medals placed annually at their disposal. It may be known to many of you that we have in Mr. Joule a pupil, a friend, and fellow-townsman of Dalton.

This theory is in perfect harmony with the opinions now very generally entertained respecting *radiant heat.* Formerly light and heat were regarded as consisting of material particles continually radiating from luminous and heated bodies respectively; but it may now be considered as established beyond controversy that light is propagated through space by the vibrations of an exceedingly refined ethereal medium, in a manner exactly analogous to that in which sound is propagated by the vibrations of the air,—and it is now supposed that radiant heat is propagated in a similar manner. This theory of radiant heat, in accordance with the dynamical theory of which I have been speaking involves the hypothesis that the particles of a heated body, or a

particular set of them, are maintained in a state of vibration, similar to that in which a luminous body is believed to be. At the same time, there are remarkable differences between light and heat. We know that light is propagated with great rapidity whether in free space or through transparent media; sound also, is propagated with great rapidity, and more rapidly through most media than air. Heat, on the contrary, whatever may be the velocity with which it may radiate through free space, is usually transmitted with extreme slowness through terrestial media. There appears to be nothing in light analagous to the slow *conduction* of heat. Again, the vibrations which render a body sonorous seem to have no tendency to expand its dimensions, nor is there reason to suppose that luminous vibrations have any such tendency on luminous bodies; whereas, with the exception of particular cases, heat does produce expansion. It is principally from this property of heat that it becomes available for the production of motive power, as for instance, in the expansion of steam. These phenomena of the slow conduction of heat and the expansion of heated bodies, are proofs of differences between light and heat not less curious than the analogies above indicated. They must, of course, be accounted for by any perfect theory of heat. Mr. Rankine has written an ingenious paper on a molecular theory of heat; but before any such theory can be pronounced upon, it will be necessary, I conceive, to see its bearing on other molecular phenomena, with which those of heat are in all probability intimately connected. Prof. W. Thompson has also given a clear and compendious mathematical exposition of the new dynamical theory of heat, fonnded on Mr. Joule's mechanical effect. This is not like Mr. Rankine's, a *molecular* theory, but one which must henceforth take the place of Carnot's theory.

Before leaving this subject, I may add that Prof. Thompson and Mr. Joule are now engagad in further experiments which will serve to elucidate the new theory of heat. Some account of the commencement of these experiments has already been brought before the Royal Society-

Many years ago Gay-Lussac made an ascent in a balloon for the purpose of making observations on the air in the upper regions of the atmosphere; but it is only very recently that systematic observations of this kind have been attempted. Last autumn four balloon ascents were made by Mr. Walsh, under the guidance of the distinguished aeronaut, Mr. Green. Attention was chiefly directed to the determination of the pressure, temperature and the moisture of the air at different altitudes. The decrease of temperature in ascending was very irregular,—being changed even in some cases to an increase; but the mean result gives a decrease of 1 Fahr. for every 348 feet of ascent,—agreeing within 5 or 6 feet with the result obtained by Gay-Lussac. The latter gentlemen ascended 23,000 feet; the greatest height attained by Mr. Welsh was 22,940. A repetition of similar observations in ascents made from different points of the earth's surface could scarcely fail to lead to valuable information for the science of Meteorology.

An immense contribution, of which mention was made by my predecessor, has been made within the last few years to this science, by the publication of Professor. Dove's Isothermal Maps, giving us the temperature of the lowest portion of the atmosphere (that which determines the *climate* of every region) for nearly all accessible points of the earth's surface. An immense number of thermometric observations had been made at fixed stations, or by travellers in almost every part of the globe, but were lying comparatively useless for want of adequate discussion. This task was undertaken some years ago by M. Dove. It was not merely a task of enormous labour, but one requiring great critical acuteness and sound philosophical judgment, and these qualifications M. Dove brought to his work, which has resulted in the excellent maps alluded to, accompanied by a considerable amount of letter-press, full of interesting generalizations, and written in the genuine spirit of inductive philosophy.

His maps present a great number of isothermal lines,—*i. e.*, lines passing through all those places which, at an assigned period of the year, have the same temperature, each line indicating a particular temperature differing a few degrees from those of the adjoining lines. Besides a large map giving these lines for January and July, the months of extreme winter and summer temperature, there are smaller ones giving similar lines for all the different months. An English edition of these maps has just been published.

We may easily conceive how a great ocean current of warm water ftom the tropics may affect the temperature of the atmosphere in the colder regions into which it may penetrate; but it is only since the publication of these maps that we have had any adequate idea of the extent of this influence, or been able to appreciate the blessings conferred on the shores of north-western Europe, and especially on our own islands, by the Gulf-stream. This great current, though not always under the same name, appears, as you are probably aware, to traverse the Atlantic in a north-westerly direction till it reaches the West India Islands and the Gulf of Mexico. It is then reflected by the American coast, and takes a north-easterly direction to our own shores, extending beyond Iceland into the North Sea. It is to the enormous mass of heated water thus poured into the colder seas of our own latitudes that we owe the temperate character of our climate; and the maps of M. Dove enable us not only to assert distinctly this general fact, but also to make an approximate calculation of the amount to which the temperature of these regions is thus affected. If a change were to take place in the configuration of the surface of the globe, so as to admit the passage of this current directly into the Pacific across the existing Isthmus of Panama, or along the base of the Rocky Mountains of North America into the North Sea—a change indefinitely small in comparison with those which have heretofore taken place—our mountains, which now present us to the ever-varying beauties of successive seasons, would become the unvarying abodes of the glacier and regions of the snow-storm; the beautiful cultivation of our soil would be no longer maintained, and civilization itself must retreat before the invasion of such physical barbarism. It is the genial influence of the Gulf-stream which preserves us from these evils. Among its effects on our climate, I may mention one which may not be without its local interest along this coast, especially for those who may wish to visit during the winter for health as well as for pleasure. The temperature of the atmosphere to the north of this island is so ameliorated by the Gulf-stream in the depth of winter, that the isothermal lines for the month of January along the whole eastern coast of Great Britain and the opposite western coast of the Continent, run north and south instead of following their normal east and west direction, thus showing that Scarborough, or any watering-place on the same coast much further to the north, enjoys as temperate a climate in the depth of winter as the coast of Kent. In the early spring, however, it becomes considerably colder than on the latter coast.

My predecessor, in his address, informed us of an application made to our Government by that of the United States, to adopt a general and systematic mode of observing phenomena of various kinds at sea, such as winds, tides, currents, &c., which may not only be of general scientific interest, but may also have an important bearing on navigation. The plan proposed by Lieut.

Maury, and adopted by the American Government, is, to have the required observations regularly made by the commanders of vessels sent out to sea. I am happy to be able to state to you that our Admiralty have given orders for similar observations to be made by those who have command of English vessels; and we trust also that persons will be appointed without delay for the reduction of the mass of observations which will thus soon be accumulated.

The science of Geology may be regarded as comprising two great divisions—the physical and the palæontological portions. The former may be subdivided into its chemical and dynamical branches. The chemical department has never made any great progress, though abounding in problems of first rate interest—such for instance, as the formation of coal, the segregation of mineral matter constituting mineral veins of all descriptions, the processes of solidification and crystallization of rocks, of the production of their jointed and laminated structure, and many others. Interesting experiments are not altogether wanting on points such as these; but not sufficient to constitute, as far as I am aware, a positive foundation and decided progress in this branch of the science. The problems, doubtless, involve great difficulties, both as regards the action of the chemical agencies themselves and the varied conditions under which they may have acted. The accomplished chemist alone can combat the difficulties of the former kind, and the geologist those of the latter. Both these characters must be united in any one who may hope to arrive at the true solution of these problems. We cannot too earnestly invite attention to this branch of geology on the part of those best qualified to contend with its difficulties.

The dynamical, or more strictly, the mechanical department of the science, has received a much larger share of attention. In fact, almost all theories and speculations of geologists, independently of organic remains belong to it, and a large portion of the work of geologists in the field has been devoted to the observation of phenomena on which it treats. *Phenomena of elevation*, those which have immediately resulted from the action of the subterranean forces which have so wonderfully scarred and furrowed the face of our globe, have been made the objects of careful research. It is to this probably violent and desolating action that we owe the accessibility of the mineral sources of our mining districts, as well as all those exquisite beauties of external nature which the mountain and the valley present to us. The absence of all order and arrangement would seem on a superficial view, to be the especial characteristic of mountainous districts; and yet the nice observations of the geologist has detected, in such districts, distinct approximations to general laws in the great dislocations and upheavals in which the mountains and valleys have originated. The more usual law in these phenomena consists in the approximate parallelism of those great lines of dislocation and chains of mountains the formation of which can be traced back to the same geological epoch. That this law is distinctly recognizable throughout districts, sometimes of many hundred miles in extent, is clearly established; but some geologists contend that it may also be recognized as prevailing over much larger geographical areas than any single geological district presents to us. M. Elie de Beaumont was the originator, and has been the great advocate, of this extension of the theory of parallellism. He extends it, in fact, to the whole surface of the earth:—using the term *parallelism* in a certain modified sense, to render it applicable to lines drawn on a spherical instead of a plain surface. His theory asserts, that all great lines of dislocation, and, therefore, all mountain chains originating in them, wherever situated, may be grouped into *parallel systems*, and that all the lines or mountain chains belonging to any one system were produced simultaneously by one great convulsion of the earth's crust. This theory has been advocated by him many years; but he has recently published his latest views respecting it, and has made an important addition, which may, in fact, be regarded as an independent theory. Each of the parallels already mentioned will have its *characteristic direction* to which all the lines of that system are parallel. This new theory asserts that these characteristic directions are not determined, as were, by accident or chance,—but that they have certain relations to each other, so that the respective systems to which they belong are disposed over the earth's surface according to a distinct symmetrical arrangement. For the details of this curious theory, I can only refer to the author's work, or the analysis which I gave of it last February in my address to the Geological Society. I feel it right, however, to add, that after an attentive examination of the subject, the evidence adduced by M. de Beaumont in support of the last mentioned theory has failed to convey conviction to my own mind. With reference to the parallelism of contemporaneous lines of elevation, no one, I conceive, will deny the truth of M. de Beaumont's theory in its application to many geological districts of limited extent; but it will probably be the opinion of most English geologists that, in attempting to extend it to districts far remote from each other, he has overstepped the bounds of legitimate induction from facts with which we are present acquainted. Every one, however, who studies M. de Beaumont's work, in whatever degree he may be disposed to adopt or reject the theoretical views of that distinguished geologist, will admit the ability and knowledge which he has brought to bear on the subject, and the advantages which must result from the ample discussion which he has given it.

One favourite subject of speculation in the physical branch of geology has been, at all times since the origin of science, the state of the interior of our planet, and the source of the high temperature observed at all considerable depths beneath its surface. The terrestial temperature at a certain depth in each locality (about 80 feet in our own region) remains constant during the whole year, being sensibly unaffected by the changing temperature of the seasons. The same, of course, holds true at greater depths; but the lower we descend the greater is this invariable temperature, the increase being proportional to the depth, and at the rate of 1 Fahr. for about every 60 or 70 feet. Assuming this rate of increase to continue to the depth of 50 miles, we should arrive at a temperature about twice as great as that necessary to fuse iron, and sufficient, it is supposed, to reduce nearly the whole mass of the earth's solid crust to a state of fusion. Hence the opinion adopted by many geologists is, that our globe does really consist of a solid shell, not exceeding 40 or 50 miles in thickness, and an interior fluid nucleus, maintained in a state of fusion by the existing remains of the heat to which the whole terrestial mass was originally subjected. It might, at first sight, appear that this enormous mass of molten matter, inclosed in so thin a shell, could scarcely be consistent with the general external condition and temperature of our globe; but it is quite certain that the real external temperature and this supposed internal temperature of the earth are not inconsistent with each other, and that no valid argument of this kind can be urged against the above hypothesis.

The above estimate, however, of the thickness of the earth's solid crust, entirely neglects the possible effects of the enormous pressure to which the terrestial mass at any considerable depth is subjected. Now, this pressure may produce effects of two kinds, bearing directly on the question before us. In the above calculation, terrestrial matter, placed at the depth of 40 or 50 miles, with a pressure of more than 200,000 pounds on the square inch, is assumed to be fusible at the same temperature as if it were subjected merely to the ordinary atmospheric pressure;

whereas the temperature of the fusion may possibly be very much increased by such immense pressure as that which I have mentioned. In such case, the terrestrial matter may be retained in a solid state at much greater depths than it otherwise would be:—*i. e.*, the solid crust may be much thicker than the above estimate of 40 or 50 miles. Again, in this estimate, it is assumed that heat will pass as easily through the most superficial portion of the earth's mass as through the compressed portions at considerable depths. Now in this assumption, there is, I think, a great *à priori* improbability, and especially with reference to those superficial rocks in which observations on the increase of terrestrial temperature in descending have generally been made, for these rocks are, for the most part, sedimentary strata, which are in general, independently of the effect of pressure, doubtless, worse conductors than the older, more compact, and more crystalline rocks. But if heat passes through the lower portions of this terrestrial mass with more rapidity than through its uppermost portion—*i e.*, if the *conductive power* be greater at greater depths—the temperature at considerable depths must increase *more slowly* as we descend than it is observed to increase at the smaller depths to which we can penetrate,—and consequently it would be necessary in such case, to descend to a greater depth before we should reach the temperature necessary to produce fusion. On this account also, as well as from the increased temperature of fusion, the thickness of the earth's crust may be much greater than the previous estimate would make it.

It has been for the purpose of ascertaining the effects of great pressure that Mr. Fairbairn, Mr. Joule, and myself, have undertaken the experiments in which we have for some time been engaged at Manchester. The first object in these experiments is, the determination of the effect of pressure on the temperature of fusion of as many substances as we may be enabled to experiment upon. We expected to meet with many difficulties in the use of the enormous pressures which we contemplated, and these expectations have certainly been fully verified; but we were also satisfied that those difficulties might be overcome by perseverance and patience, and in this also we have not been disappointed—for I may now venture to assert that our ultimate success, with respect to a number of substances, is beyond doubt. Without the engineering resources, however, at Mr. Fairbairn's command, success would have been hopeless.

At present our experiments have been restricted to a few substances, and those of easy fusibility; but I believe our apparatus to be now so complete for a considerable range of temperature, that we shall have no difficulty in obtaining further results. Those already obtained indicate *an increase in the temperature of fusion proportional to the pressure to which the fused mass is subjected.* In employing a pressure of about 13,000 lbs. to the square inch on bleached wax, the increase in the temperature of fusion was not less than 30° Fahr.,—about one-fifth of the whole temperature at which it melts under the pressure of the atmosphere. We have not yet ascertained the degree in which the conductive power of any substance may be increased when solidified under great pressure. This point we hope to investigate with due care; and also to determine the effects on substances thus solidified, with respect to their density, strength, crystalline forms, and general molecular structure. We thus hope to obtain results of general interest and value, as well as those which may bear more directly on the questions which first suggested the experiments.

Among researches for determining the nature of the earth's crust at greater depths than those to which we can penetrate, I must not omit to mention Mr Mallet's very elaborate report on Earthquakes, contained in the last two volumes of the Reports of the Association. This *Earthquake Catalogue* is preceded by an account of some very interesting and carefully conducted experiments on the transmission of vibrations through solid media. These results will be found of great value, whenever the subject of earthquakes shall receive that careful attention which it so well deserves. Insulated observations, and those casual observations, and those casual notices which are now frequently given of earthquake phenomena, are utterly useless for scientific purposes. There are no observations which require more to be regulated by system and combination than those of the phenomena in question; and I should rejoice to see the influence of the association exerted for this purpose when some efficient mode of proceeding shall have been devised.

Some of the most interesting of recent discoveries in organic remains are those which prove the existence of reptilian life during the deposition of some of our oldest fossiliferous strata. An almost perfect skeleton of a reptile belonging to the Batrachians or Lacertians was lately found in the Old Red Sandstone of Morayshire. The remains of a reptile were also discovered last year by Sir Charles Lyell and Mr. Dawson in the coal measures of Nova Scotia; and a batrachoid fossil has also been recognized in British coal shale. But the most curious evidence of the early existence of animals above the lower orders of organization on the face of our globe, is that afforded by the footprints discovered a short time ago in Canada by Mr. Logan on large slabs of the oldest fossiliferous rocks,—those of the Silurian epoch. It was inferred from the more imperfect specimens first brought over, that these footmarks were the marks of some reptile; but more perfect examples, afterwards supplied by Mr. Logan, satisfied Prof. Owen that they were the impressions of some animal belonging to the Articulata, probably a crustacean. Thus the existence of animals of the reptile type of organization during the carboniferous and Devonian periods is clearly established; but no evidence has yet been obtained of the existence of those animals during the Silurian period. After the discoveries which I have mentioned, however, few geologists will perhaps be surprised should we hereafter find that higher forms of animal life were introduced upon the earth during this early period than have yet been detected in its sedimentary beds.

Many of you will be aware that there are two theories in geology, which may be styled the theories of ***progression*** and of ***non-progression*** respectively. The former asserts that the matter which constitutes the earth has passed through continuous and progressive changes from the earliest state in which it existed to its actual condition at the present time. The earliest state here contemplated may have been a fluid, or even a gaseous state, due to the enormous primitive heat of the mass, and it is to the gradual loss of that heat that the progressive change recognized by this theory is chiefly attributed. The theory of ***non-progression***, on the contrary, recognizes no primitive state of our planet differing essentially from its existing state. The only changes which it does recognize being those which are strictly periodical, and therefore produce no permanent alteration in the state of our globe. With reference to organic remains, the difference between these theories is exactly analogous to that now stated with reference to inorganic matter. The theory of ***progression*** asserts that there has been a general advance in the forms of organic life from the earliest to the more recent geological periods. This advance must not be confounded, it should be observed, with that progressive developement according to which animals of a higher organic structure are but the improved lineal descendants of those of the lowest grade, thus abolishing all distinction of species. It is merely meant to assert that the higher types of organic being are far more generally diffused at the present time, and far more numerous and varied than they were at the earlier geological periods; and that, moreover, at the earliest of those periods which

the geologist has been able to recognize, some of these higher types had propably no existence at all.

Each successive discovery, like those which I have mentioned, of the remains of animals of the higher types in the older rocks, is regarded by some geologists as an addition to the cumulative evidence by which they conceive that the theory of *non-progression* will be ultimately established; while others consider the deficiency in the evidence required to establish that theory as far too great to admit the probability of its being supplied by future discovery. Nor can the theory derive present support, it is contended, by an appeal to any properties of inorganic matter, or physical laws, with which we are acquainted. Prof. W. Thomson has recently entered into some very interesting speculations bearing on this subject, and suggested by the new theory of heat of which I have spoken. The heat of a heavenly body placed under the same conditions as the sun, must, it has been said, be ultimately exhausted by its rapid emission. This assertion assumes the matter composing the sun to have certain properties like those of terrestrial matter with respect to the generation and emission of heat; but Prof. Thomson's argument places the subject on better grounds, admitting, always, the truth of the new theory of heat. That theory asserts, in the sense which I have already stated, the exact equivalence of heat and motive power; and that a body, in sending forth heat must lose a portion of that internal motion of its constituent particles on which its thermal state depends. Now we know that no mutual action of these constituent particles can continue to generate motion which might compensate for the loss of motion thus sustained. This is a simple deduction from dynamical laws and principles, independent of any property of terrestrial matter which may possibly distinguish it from that of the sun. Hence, then, it is on these dynamical principles that we may rest the assertion that the sun cannot continue for an indefinite time to emit the same quantity of heat as at present, unless his thermal energy be renovated from some extraneous source. The same conclusion may be applied to all other bodies in the universe which, like our sun, may be centres of intense heat; and, hence, recognizing no adequate external supplies of heat to renovate these existing centres of heat, Prof. Thomson concludes that the dispersion of heat, and consequently of physical energy, from the sun and stars into surrounding space without any recognizable means of reconcentration, is the existing order of nature. In such case the heat of the sun must ultimately be diminished, and the physical condition of the earth therefore altered, in a degree altogether inconsistent with the theory of non-progression.

Mr. Rankine, however, has ingeniously suggested an hypothesis according to which the reconcentration of heat is conceivable. Assuming the physical universe to be of finite extent and surrounded by an absolute *vacuum*, radiant heat (supposing it to be propagated in the same way as light) would be incapable of passing into the *vacuum*, and would be reflected back to foci corresponding to the points from which it emanated. A reconcentration of heat would thus be effected; and any of the heavenly bodies which had previously lost their heat, might, on passing through these foci, be rekindled into bright centres of radiant heat. I have alluded more particularly to this very ingenious, though, perhaps, fanciful hypothesis, because some persons have, I believe, regarded this view of the subject as affording a sanction to the theory of *non-progression;* but even if we should admit its truth to the fullest extent, it may be deemed, I think, entirely inconsistent with that uniformity and permanence of physical condition in any of the heavenly bodies which the theory just mentioned requires in our own planet. The author of this hypothesis did not possibly contemplate any such application of it; nor am I aware how far he would advocate it as really applicable to the actual constitution of the material universe, or would regard it as suggesting a possible and conceivable, rather than a probable, mode of counteracting the constant dispersion of heat from its existing centres. He has not, I think, attempted to work out the consequences of the hypothesis as applied to *light*,—to which it must, I conceive, be necessarily considered applicable if it be so to heat. In such case the foci of the reflected heat would be coincident with those of the reflected light, proceeding originally from the same luminous bodies. These foci would thus become visible as the images of stars; so that the apparent number of stars would be constantly increasing with the increasing number of images of each star produced by successive reflexions. This will scarcely be considered the actual order of nature. It would be easy to trace other consequences of the application of this hypothesis to light; but I would at present merely state that my own convictions entirely coincide with those of Prof. Thomson. If we are to found our theories upon our knowledge, and not upon our ignorance of physical causes and phenomena, I can only recognize in the existing state of things a passing phase of the material universe. It may be calculated in all, and is demonstrably so in some respects, to endure under the action of known causes, for an inconceivable period of time; but it has not, I think, received the impress of eternal duration in characters which man is able to decipher. The external temperature any physical conditions of our own globe may not, and probably cannot, have changed in any considerable degree since the first introduction of organic beings on its surface; but I can still only recognize in its physical state during all geological periods, a state of actual though exceedingly slow progression, from an antecedent to some ultimate state, on the nature of which our limited powers will not enable us to offer any conjecture founded on physical research. The theories, even, of which I have been speaking, may probably appear to some persons as not devoid of presumption; but for many men they will ever be fraught with deep speculative interest:—and, let me add, no charge of presumption can justly lie against them if entered upon with that caution and modesty which ought to guide our inquiries in these remote regions of physical science.

I feel how imperfect a view I have now submitted to you of recent scientific proceedings. I have given no account of the progress of Chemistry, of Practical Mechanics, or of the sciences connected with Natural History; nor have I spoken of Ethnology, a science which, though of such recent date, is become of great interest, and one which is occupying the minds of men of great learning and profound research. I can only hope that the chair which I have now the honor to occupy, will be henceforth filled by men qualified to do full justice to these important branches of science. I trust that what I have said, however, will convey to you some idea of the activity which pervades almost every department of science.

I must not conclude this Address without some mention of what appear to me to be the legitimate objects of our Association—nor without some allusion to circumstances calculated, I think, to give increased importance to its general working and influence.

There are probably few amongst us of whom the inquiry has not been made—after any one of our meetings—whether any striking discovery had been brought forward?—and most of us will also probably have remarked that an answer in the negative has frequently produced something like a feeling of disappointment in the inquirer. But such a feeling can arise only from a misapprehension of what I conceive to be the real and legitimate objects of the British Association. Great discoveries do not require associations to proclaim them to the world. They proclaim themselves. We do not meet to receive their announcement, or

to make a display of our scientific labours in the eyes of the world, or to compliment each other on the success that we may have met with. Outwa d display belongs not to the proceedings, and the expression of mutual compliment belongs not to the language, of earnest-minded men. We meet, gentlemen, if I comprehend our purpose rightly, to assist and encourage each other in the performance of the laborious daily tasks of detailed scientific investigation. A great thought may possibly arise almost instantaneously in the mind,—and the intuition of genius may almost as immediately recognize its importance, and partly forsee its consequences. Individual labor may also do much in establishing the truth of a new principle or theory; but what an amount of labour may its multifarious applications involve! Nearly two centuries have not sufficed to work out all the consequences of the principle of gravitation. Every theory as it becomes more and more perfectly worked out embraces a greater number of phenomena, and requires a greater number of labourers for its complete developement. Thus it is that when science has arrived at a certain stage, combination and co-operation become so essential for its further progress. Each scientific society effects this object to a greater or less degree,—but much of its influence may be of a local character, and it is usually restricted by a limited range of its objects. Up to a certain point no means are probably so effective for the promotion of science as those particular Societies which devote themselves to one particular branch of science; but as each science expands, it comes into nearer relations with other sciences, and a period must arrive in this general and progressive advance which must render the co-operation of the cultivators of different branches of science almost as essential to our general progress as the combination of those who cultivate the same branch was essential to the progress of each particular science in its earlier stages. It is the feeling of the necessity of combination and of facility of intercourse among men of science that has given rise to a strong wish that the scientific Memoirs of different Societies should be rendered, by some general plan, more easily and generally accessible than they are at present;—a subject which I would press on your consideration. It is by promoting this combination that the British Association has been able to exert so beneficial an influence,—by bringing scientific men together, and thus placing, as it were, in juxtaposition every Society in the country. But how has this influence been exercised? Not assuredly in the promotion of vague theories and speculative novelties; but in the encouragement of the hard daily toil of scientific research, and by the work which it has caused to be done, whether by its influence over its individual members or on the Government of the country. Regarding our Association, gentlemen, in this point of view, I can only see an increased demand for its labours, and not a termination of them, in the future progress of science. The wider the spread of science, the wider will be the sphere of its usefulness.

We should do little justice to the great Industrial Exhibition, which, two years ago, may be literally said to have delighted millions of visitors, or to the views of the illustrious Prince with whom it originated, if we should merely recollect it as a spectacle of surpassing beauty. It appears destined to exercise a lasting influence on the mental culture, and therefore, we may hope, on the moral condition of the great mass of our population, by the impulse which it has given to measures for the promotion of general education. We may hope that those whose duty it will be to give effect to this impulse, will feel the importance of education in Science as united with education in Art. An attempt to cultivate the taste alone, independently of the more general cultivation of the mind, would probably fail, as it would deserve to do. I trust that the better education which is now so universally recognized as essential to preserve our future pre-eminence as a manufacturing nation, will have its foundations laid, not in the superficial teaching which aims only at communicating a few curious results, but in the sound teaching of the fundamental and elementary principles of science. Art ought assuredly to rest on the foundation of Science. Will it, in the present day, be contended that the study of science is unfavourable to the cultivation of taste? Such an opinion could be based only on an imperfect conception of the objects of Science, and an ignorance of all its rightful influences? Does the great sculptor or the historical painter despise anatomy? On the contrary, he knows that a knowledge of that science must constitute one of the most valuable elements of his art if he would produce the most vigorous and characteristic expression of the human figure. And so the artist should understand the structure of the leaf, the tendril, or the flower, if he would make their delicate and characteristic beauties subservient either to the objects of decorative art, or to those of the higher branches of sculpture and painting. Again, will the artist appreciate less the sublimity of the mountain, or represent its characteristic features with less truthfulness, because he is sufficient of a geologist to trace the essential relations between its external form and its internal constitution? Will the beauty of the lake be less perfectly imitated by him if he possess a complete knowledge of the laws of reflection of light? Or will he not seize with nicer discrimination all those varied and delicate beauties which depend on the varying atmosphere of our own region, if he have some accurate knowledge of the theory of colours, and of the causes which govern the changeful aspects of mist and cloud? It is true, that the genius and acute powers of observation of the more distinguished artists may compensate, in a great degree, for the want of scientific knowledge; but it is certain that a great part of the defects in the works of artists of every description may be traced to the defect of scientific knowledge of the objects represented. And hence it is that I express the hope that the directors of the important educational movement which is now commencing with reference to industrial objects will feel the necessity of laying a foundation, not in the complicated details of science, but in the simple and elementary principles which may place the student in a position to cultivate afterwards, by his own exertions, a more mature acquaintance with those particular branches of science which may be more immediately related to his especial avocations. If this be done, abstract science will become of increased estimation in every rank of society, and its value, with reference, at least to its practical applications will be far better understood than it is generally amongst us at the present time.

Under such circumstances the British Association could not fail to become of increased importance, and the sphere of its usefulness to be enlarged. One great duty which we owe to the public is, to encourage the application of abstract science to the practical purposes of life—to bring, as it were, the study and the laboratory into juxta-position with the workshop. And, doubtless, it is one great object of science, to bring more easily within reach of every part of the community the rational enjoyments, as well as the necessaries of life; and thus not merely to contribute to the luxuries of the rich, but to minister to the comforts of the poor, and to promote that general enlightenment so essential to our moral progress, and to the real advancement of civilization. But still, we should not be taking that higher view of science which I would wish to inculcate, if we merely regarded it as the means of supplying more adequately the physical wants of man. If we would view science under its noblest aspects, we must regard it with reference to man, not merely as a creature of physical wants, but as a being of intellectual and moral endowments, fitting him to discover and comprehend some part at least of the laws which govern the material universe, to admire the harmony which

pervades it, and to love and worship its Creator. It is for science, as it leads to this contemplation of nature, and to a stronger sense of the beauties which God has spread around us, that I would claim your deeper reverence. Let us cultivate science for its own sake, as well as for the practical advantages which flow from it. Nor let it be feared lest this cultivation of what I may term contemplative science, if prosecuted in a really philosophic spirit, should inspire us with vain and presumptuous thoughts, or disqualify us for the due appreciation of moral evidence on the most sacred and important subjects which can occupy our minds. There is far more vanity and presumption in ignorance than in sound knowledge; and the spirit of true philosophy, be it ever remembered, is a patient, modest, and a humble spirit.

The Narcotics we indulge in.*

II. The Hop which may now be called the *English narcotic*, was brought from the Low Countries, and is not known to have been used in malt liquor in this country till after the year 1524, in the Reign of Henry VIII. In 1850 the quantity of hops grown in England was 21,668 tons, paying a duty of £270,000. This is supposed to be a larger quantity than is grown in all the world besides. Only 98 tons were exported in that year; while, on the other hand, 320 tons were imported, so that the home consumption amounted to 21,886 tons, or 49 millions of pounds; being two thirds more than the weight of the tobacco which we yearly consume. It is the narcotic substance, therefore, of which England not only grows more and consumes more than all the world besides, but of which Englishmen consume more than they do of any other substance of the same class.

And who that has visited the hop grounds of Kent and Surrey in the flowering season, will ever forget the beauty and grace of this charming plant? Climbing the tall poles and circling them with the clasping tendrils, it hides the formality and stiffness of the tree that supports it among the exuberant profusion of its clustering flowers. Waving and drooping in easy motion with every tiny breath that stirs them, and hanging in curved wreaths from pole to pole, the hopvines dance and glitter beneath the bright English vineyard, which neither the Rhine nor the Rhone can equal, and only Italy, where her vines climb the freest, can surpass.

The hop "joyeth in a fat and fruitful ground," as old Gerard hath it (1596). "It prospereth the better by manuring." And few spots surpass, either in natural fertility or in artificial richness, the hop lands of Surrey, which lie along the out-crop of the green sand measures in the neighbourhood of Farnham.—Naturally rich to an extraordinary degree in the mineral food of plants, the soils in this locality have been famed for centuries for the growth of hops; and with a view to this culture alone, at the present day, the best portions sell as high as £50 an acre. And the *highest* Scotch farmer—the most liberal of manure—will find himself outdone by the hop-growers of Kent and Surrey. An average of ten pounds an acre for manure over a hundred acres of hops, make this branch of farming the most liberal, the most remarkable, and the most expensive of any in England.

This mode of managing the hop, and the peculiar value and rarity of hop land, were known very early. They form parts of its history which were probably imported with the plant itself. Tusser, who lived in Henry VIII's time, and in the reign of his three children, in his *Points of Husbandry* thus speaks of the hop:—

"Choose soil for the hop of the rottenest mould,
Well doonged and wrought as a garden-plot should:
Not far from the water (but not overflowne,)
This lesson well noted, is meet to be knowne.

The sun in the south, or else southlie and west,
Is joy to the hop as welcommed ghest;
But wind in the north, or else northerly eas,
To hop is as ill as fray in a feast.

Meet plot for a hop-yard, once found as is told,
Make thereof account, as of jewel of gold;
Now dig it and leave it, the sun for to burne,
And afterwards fense it, to serve for that turne.

The hop for his profit, I thus do exalt;
It strengtheneth drink, and favoureth malt;
And being well brewed, long kep it will last,
And drawing abide, if ye draw not too fast."*

The hops of commerce consist of the female flowers and seeds of the *humulus lupulus*, or common hop plant. Their principal consumption is in the manufacture of beer, to which they give a pleasant, bitter, aromatic flavour, and tonic properties. Part of the soporific quality of beer also is ascribed to the hops, and they are supposed by their chemical properties to check the tendency to become sour. The active principles in the hop consist of a volatile oil, and a peculiar bitter principle to which the name of *lupulin* is given.

When the hop flowers are distilled with water, they yield as much as eight per cent of their weight of volatile oil, which has a brownish yellow colour, a strong smell of hops, and a slightly bitter taste. In this "oil of hops" it has hitherto been supposed that a portion of the narcotic influence of the flowers resided, but recent experiments render this opinion doubtful. It is probable that in the case both of tobacco and of the hop, a volatile substance distils over in small quantity along with the oil, which has not hitherto been examined separately, and in which the narcotic virtue resides. This is rendered probable by the fac that the rectified hop oil is not possessed of narcotic properties

The hop has long been celebrated for its sleep giving qualities To the weary and wakeful, the hop-pillow has often given refreshing rest, when every other sleep-producer had failed. It is to the escape, in minute quantities, of the volatile narcotic substances we have spoken of, that this soporific effect of the flowers is most probably to be ascribed.

Besides the oil and other volatile matter which distil from them, the hop flowers, and especially the fine powdery grains or dust, which by rubbing, can be separated from them, yield to alcohol a bitter principle (lupulin) and a resinous substance, both in considerable proportions. In a common tincture of hops these substances are contained. They are aromatic and tonic, and impart their own qualities to our beer. They are also soothing, tranquilising, and in a slight degree sedative and soporific, in which properties well-hopped beer also resembles them. It is certain that hops possess narcotic virtue which beer derives from them;* but in what part of the female flower, or in what peculiar chemical compound this narcotic property chiefly resides, is still a matter of doubt.

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* *Five Hundred Points of Good Husbandry*. London edition of 1312, p. 167.

* *Ale* was the name given to unhopped malt-liquor before the use of hops was introduced. When hops were added, it was called *beer*, by way of distinction, I suppose, because we imported the custom from the Low Countries, where the word beer was, and is still, in common use. Ground ivy (*Glechoma hederacea*) called also alehoof and tunhoof, was generall employed for preserving ale before the use of hops was known. "The manifold virtues in hops," says Gerard, in 1596, "do manifestly argue the holsomeness of *beere* above *ale*, for the hops rather make it physicall drink to keep the body in health, than an ordinary drink for the quenching of o thirst."

To the general reader it may appear remarkable, that the chemistry of a vegetable production, in such extensive use as the hop, should still be so imperfect—our knowledge of its nature and composition so unsatisfactory. But the well-read chemist, who knows how wide the field of chemical research is, and how rapidly our knowledge of it, as a whole, is progressing, will feel no surprise. He may wish to see all such obscurities and difficulties cleared away, but he will feel inclined rather to thank and praise the many ardent and devoted men, now labouring in this department, for what they are doing, than to blame them for being obliged to leave a part of the extensive field for the present uncultivated.

Among largely used narcotics, therefore, especially in England, the hop is to be placed. It differs, however, from all others we have mentioned, in being rarely employed alone, except medicinally. It is added to infusions like that of malt, to impart flavour, taste, and narcotic virtues. Used in this way, it is unquestionably one of the sources of pleasing excitement and healthy tonic action, which well-hopped beer is known to produce upon those who drink it. Other common vegetable productions will give the bitter flavour to malt liquor. Horehound, wormwood, and gentian, and quassia, and strichnia, and the grains of paradise, and chicory, and various other plants, have been been used to replace or supplant the hop. But none are known to approach it in imparting those peculiar qualities which have given the bitter beer of the present day so well merited a reputation.

Among our working classes, it is true, in the porters and humbler beers, they consume and prefer, the *Cocculus indicus* finds a degree of favour which has caused it, to a considerable degree, to take the place of the hop. This singular berry possesses an intoxicating property, and not only replaces the hop by its bitterness, but to a certain extent also supplies the deficiency of malt. To weak extracts of malt it gives a richness and *fulness in the mouth*, which usually imply the presence of much malt, with a bitterness which enables the brewer to withhold one-third of his hops, and a colour which aids him in the darkening of his porter. The middle-classes in England prefer the thin wine-like bitter beer. The skilled labourers in the manufacturing districts prefer what is rich, full, and substantial in the mouth. With a view to their taste, it is too often drugged with the *Cocculus indicus* by disreputable brewers; and much of the very beastly intoxication which the consumption of malt liquor in England produces, is probably due to this pernicious admixture. So powerful is the effect of this berry on the apparent richness of beer, that a single pound produces an equal effect with a bag of malt. The temptation to use it, therefore, is very strong. The quantity imported in 1850 was 2359 cwt., equal to a hundred and twelve times as many bags of malt; and although we cannot strictly class it among the narcotics we voluntarily indulge in, it may certainly be described as one in which thousands of the humbler classes are compelled to indulge.

It is interesting to observe how men carry with them their early tastes to whatever new climate or region they go. The love of beer and hops has been planted by Englishmen in America. It has accompanied them to their new empires in Australia, New Zealand and the Cape. In the hot East their home taste remains unquenched, and the pale ale of England follows them to remotest India. Who can tell to what extent the use of the hop may become naturalised, through their means, in these far-off regions? Who can predict that, inoculated into its milder influence, the devotees of opium and the intoxicating hemp may not hereafter be induced to abandon their hereditary drugs, and to substitute the foreign hop in their place? From such a change in one article of consumption, how great a change in the character of the people might we not anticipate?

This leads us to remark, that we cannot as yet very well explain in what way and to what extent the use of prevailing narcotics is connected, as cause or effect, with peculiarities in national character. But there can no longer be any doubt that the soothers and exciters we indulge in, in some measure as the luxuries of life, though sought for at first merely to gratify a natural craving, do afterwards gradually but sensibly modify the individual character. And where the use is general and extended, the influence of course affects in time the whole people. It is a problem of interest to the legislator, not less than to the physiologist and psychologist, to ascertain how far and in what direction such a reaction can go—how much of the actual tastes, habits, and character of existing nations has been created by the prolonged consumption of the fashionable and prevailing forms of narcotics in use among them respectively, and how far tastes and habits have been modified by the changes in these forms which have been introduced and adopted within historic times. The reader will readily perceive that this inquiry has in it a valid importance, quite distinct from that which attaches itself to the supposed influence of the different varieties of intoxicating fermented drinks in use in different countries. The latter, as we have said, all contain the same intoxicating principle, and so far, therefore, exercise a common influence upon all who consume them. But the narcotics now in use owe their effects to substances which in each, so far as is known, are chemically different from those which are contained in every one of the others. They must exercise, therefore, each a different physiological effect upon the system, and if their influence, as we suppose, extends so far, must each in a special way modify also the constitution, the habits, and the character.

Our space does not permit us, in the present number, to speak of the use of opium and hemp; we shall return to these extensively consumed drugs on a future occasion.

Notes of a Short Tour from Montreal to Portland and the White Mountains.

Although we perceive by a paragraph in the *International Journal*, that the *White Mountain Tour* is over, water having, on the night of the 15th ultimo, frozen an inch thick at the Glen House, at the foot of Mount Washington, we have much pleasure in laying before our readers the following Notes of a visit to that quarter *by a Member of the Institute*, in the hope of its being instrumental in inducing many a Canadian tourist to direct his steps to the same interesting region next season.

Having a short time ago paid a hasty visit, per rail, to the finely situated and beautiful city of Portland, and had the gratification of snuffing the exhilirating sea-breeze at Cape Elizabeth, and having also, on my way back, made a detour from Gorham to the lofty summit of the noted Mount Washington, the monarch of the New Hampshire mountains, I would fain recommend to a few of your readers to follow my example, while the season is favourable, as sure to lead to much enjoyment; so accept, if you please, the following rambling memorandum of my tour.

For particulars respecting the different places passed *en route* to Portland, it would be as well to refer to one of the Guide Books.* But lest our tourist should not be provided with so

* The Portland, White Mountain, and Montreal Railroad Guide, published at Portland, and to be had at Mr. Armour's, in Great St. James Street, is recommended, as having been of considerable use to ourselves, in noting down distances, and directing our attention to many interesting objects and facts.

useful a companion, I would recommend to his particular attention in succession, the interesting scenery in the vicinity of Boucherville mountain, 10 miles from Montreal; and 9 miles further, beyond the river Richelieu, the pretty little village of St. Hilaire, and the fine estate and attractive residence of Major Campbell, the Seigneur of Rouville, to the left, with the wood-clad isolated mountain of Belœil to the right; and, 13 miles further, the cheerful looking thriving town of St. Hyacinthe, situated on the river Yamaska, and noted for its Catholic College. About five miles beyond this, you exchange the cultivated prairie land of the St. Lawrence valley, for a gradually ascending forest tract of country which continues more or less until about 42 miles further you cross the fine river St. Francis, where the line of Railway to Quebec turns off to the left, while that to Portland makes a curve to the South, with the village of Richmond on one bank of the river, and that of Melbourne on the other.

From thence you follow the interesting valley of the St. Francis,—not unfrequently close along the banks, for about 24 miles, when you cross it before arriving at the finely "located" and important rising town of Sherbrooke, the highly promising capital of the Eastern Townships, most eligibly situated, at the confluence of the river Magog with the St. Francis,—and at which it would be well worth while to halt a day, to inspect its various manufactures, and take a ramble among the attractive scenery along the noisy but useful Magog, until it plunges down a succession of rocky declivities, to meet the more placid and broader St. Francis.

Renewing yonr rapid journey, about 3 miles on you pass the pretty village of Lennoxville, chiefly noted for its Episcopal College, and immediately afterwards cross the little river Coaticooke, at its junction with the St. Francis, and follow up the course of the latter, past Compton, to near its source, in a pretty lakelet called Norton Pond,—crossing in the meantime the boundary line between Canada and Vermont, about 127 miles from Montreal; and about 16 farther, you reach the picturesque and prospectively important station and village of Island Pond, so called from the small island on the pretty little lake on which it is situated, 143 miles from Montreal. Soon after passing Island Pond you cross the ridge of the Green Mountains, here 1176 feet above the sea, and forming the boundary between the States of Vermont and New Hampshire.

From this interesting point, you proceed through a highly picturesque Highland tract of country, bounded on either hand by the towering peaks of the White Mountains, (two of which, on the left, are particularly remarkable for their bare, hoary fronts,) *via* Stratford, 15 miles, Northumberland, 12 miles, Milan, 18 miles, and Birlin Falls, 7 miles, to what is indiscriminately called the Alpine and Gorham House, when you have attained an elevation of 802 feet above the level of the sea, and are 201 miles from Montreal, and 91 from Portland.

This being a very commodious and agreeably situated hotel it might be well to remain a day or two here, if you can afford it, to enjoy a ramble among the surrounding Alpine scenery; but that not being at present our intention, let us hasten on to Portland, merely noting by the way that among the most attractive points on this still romantic route are Gilead station, 11 miles—a mile or two before arriving at which the railroad crosses the boundary between New Hampshire and Maine, and from whence, it is worthy of remark, the grade is said to have a descent of 60 feet in the mile;—Mechanics' Falls, 19 miles, Danville Junction, 16 miles, the pretty seaports of Yarmouth, 11 miles, and Falmouth, 6,—and, last of all, Portland, 5 miles, crossing half-way a bridge over a creek or inlet of the sea of about 300 feet—making altogether a journey of 291 miles, accomplished in the short space of 12 hours!

Having enjoyed a day or two in rambling about, and admiring the prosperous interior, as well as the interesting and picturesque environs of "the Forest City," a distinctive appellation deservedly acquired by Portland from the numerous shady trees which embellish its fine, broad streets, let us prepare to return homewards, with the intention of devoting at least one day to a detour from Gorham, to scale the lofty summit of Mount Washington.

No sooner did the cars reach Gorham, than we learnt that a covered four-horse waggon was about to start immediately with a load of tourists for the Glen House, about seven miles distant, near the foot of Mount Washington; and therefore no time was to be lost; so, transferring our cloak and carpet bag from the train to this vehicle, we, (consisting of myself and a worthy friend bent on the same expedition,) joined a merry party of some ten or twelve more, and were soon jolting on our sluggish way, "through woods and wilds," up the rather romantic vale of the stony-bedded little river Peabody, to Glen House,—to find in this sequestered spot a very commodious and comfortable hotel situated on a cheerful, open, rising ground, considered 830 feet above the level of Gorham, and hemmed in on every side by an imposing circle of towering mountains, among the most prominent of which rise Mounts Adams and Jefferson, overlooked by their loftier superior, Mount Washington.

Those only who have visited this singularly situated mansion, can well imagine the imposing grandeur of the surrounding Alpine prospect;—and I will therefore not attempt to delineate it. Suffice it to note, that after a comfortable night's rest and a hearty breakfast next morning, we set out with a party of six or seven others, to encounter the toil of a five mile scramble to the top of Mount Washington, on foot; while a few others, and among these several ladies, preferred doing so on horseback—which, steep and rugged as the path was described to be, we could not help thinking would prove the most toilsome and dangerous mode of travel.

Shortly after leaving the Glen House, you descend into the stony bed of the Peabody, and after crossing it dry-shod, by means of stepping stones and a friendly plank, the path enters dense forest, composed of every variety of trees, such as beech, birch, maple, oak, hemlock, mountain ash, spruce and other kinds of firs, with a tangled undergrowth of various shrubs and plants, so as to shut out the view on every side. We had not advanced above a mile or two up our steep and rugged path, amid rocks and roots, and mud and mire, and begun congratulating ourselves on having wisely preferred journeying on foot; when lo! we were startled by the sound of voices in our rear; and soon after approached and passed us the expected party on horseback, threading their way up the craggy defile at a wonderful rate, at the discretion of their singularly sure-footed little nags. "*Chacun a son gout*," notwithstanding, thought I, as I perceived the riders hurried forward, as it were involuntarily, with their eyes anxiously fixed between the ears of their steeds, while we were left at liberty to halt and take breath, or turn to snatch an occasional glimpse at the imposing scenery above and below us. Even this, however, could not be enjoyed until nearly half-way up, after having exchanged the dense forest for a higher zone or belt of stunted vegetation, consisting chiefly of dwarf spruce and cedars, to be succeeded, about two-thirds from the top, by a dreary tract of utterly shrubless, lichen-clad fragments of rock, scattered in wild confusion, all the rest of the way to the summit.

On at last nearing the anxious object of our pilgrimage, the delighted eye meets in the distance a long, low, rough-built shed, snugly nestled among the shapeless masses of rock, and dignified with the imposing name of the "*Summit House*," or "*Hotel*,"—

with a lofty wooden platform behind it, surmounted by the "star-spangled banner." To this welcome though lowly mansion, we gladly directed our weary steps, assured, from report, that we should find in it every reasonable comfort and accommodation, whether for day or night; and we were not disappointed; finding the interior to consist of one long dining apartment, with the table ready spread,—with a sort of sitting or reading room at one end, and the kitchen department at the other; while along the whole of one side extended a range of small bed-closets or state-rooms, with upper and lower berths, steamboat fashion,—sufficient to accommodate 30 or 40 tourists—if wanted, to double upon emergency, in such out-of-the-way quarters, and who, as we can vouch from experience, will, if not too fastidious, find themselves in all other respects very comfortably fed and cared for, at a very reasonable rate, during their sojourn on so very extraordinary a spot.

After a short rest, to recruit our weary limbs,—for though the distance from the Glen House to the summit is not more than five and a half miles, we found we had taken five hours to ascend, including an hour's rest at different intervals, after quitting the viewless forest region, to enjoy the contemplation of the surrounding singularly imposing panorama, and pick up a few geological specimens, we sallied forth to take a more leisurely survey of the utterly bleak and desolate scene immediately before us, compared with the more cheering diversified distant prospect, with the aid of the large telescope on the top of the neighbouring platform; when lo! what should we observe close by, but a rival *hotel*, of lesser dimensions, dignified with the name of "The Tip-Top House,"—of which more hereafter—my business at present being to attempt to give something of a description of the wild Alpine region around us. Well, I have endeavoured to summon all my descriptive powers; but I find myself unable to do justice to the subject; so must be content to confess myself incompetent to the task, and to beg my readers to go and judge for themselves, and they will possibly find themselves in the same embarrassing predicament. Suffice it then to request the tourist to fancy himself occupying the solitary central point of a vast circle of at least 200 miles in diameter, and looking round on every hand on a retiring succession of five or six ranges of lofty mountains, rising behind each other like gigantic waves in a tempestuous ocean, and he will have some slight idea of the extraordinary scene then before us. Let him then take a glance at the few far-stretching intervening valleys within view, and he will be able to count ten or twelve lakes or lakelets sprinkled about in different directions. And, after again contemplating the towering summits immediately round him, let him gradually take a wider range, and among the various particularly noticeable objects, the Green Mountains of Vermont will be pointed out to him in the western distance, on the one hand, while if the day be favourable, a flitting bright speck may sometimes be seen, on the verge of the south-eastern horizon, near 100 miles distant, which he will be told is a white sail on the Atlantic, near Portland.

The morning on which we ascended Mount Washington had been particularly favourable for a distant prospect; but by the time we reached the summit, a thin purple haze had so veiled the remote landscape, that it was all that we could do to recognize the ocean; and such continued to be the case till towards evening, when the wind rapidly increasing, the wild sunset scene became particularly imposing, from being contrasted with a calm, white bed of fleecy clouds that had gradually enveloped and settled round the neighbouring mountain tops and sides, while a second higher stratum of clouds kept rushing wildly past, and down into the intermediate valleys, without at all disturbing the placid surface of the former, until at last the setting sun became obscured, and darkness gradually veiling the solemn scene, the whole mountain region became enveloped in a winding-sheet of cold, dense mist:—but not before an extra interesting object had been added to the awfully sublime landscape, by the opportunity of, for the first time, gazing at the long-tailed stranger—the Comet,—wending his mysterious way down the western horizon.

Not being quite satisfied with one imperfect evening prospect, we determined to enjoy next morning, if possible, the beauties and splendours of dawn and sunrise; but in this we were doomed to be wofully disappointed;—for the angry spirit of the mountain had, during the night, sent forth from the N. W. a perfect gale, accompanied by a driving, drizzling mist of such density, that in the morning we were obliged to console ourselves with a hearty breakfast, and to make the best of our disappointed way to the lower regions before the storm, by the old rugged path, at the occasional risk of being blown down "at one fell swoop" all the way to Glen House, where, however, we fortunately arrived without accident in somewhat more than three hours, just as the clouds began to pour forth a hearty shower.* A renovated toilet and a hearty dinner soon set all right, and in about an hour afterwards we were *en route*, in spite of wind and rain, back to Gorham House, to be soon after whirled comfortably along by rail as far as Sherbrooke—to halt for a day—where I propose bidding my reader adieu, after putting him in possession of a few more hints regarding the wild mountain region which we have left behind us.

To the mere summer tourist, whose only aim is locomotive novelty as a lover of the romantic, a visit to the White Mountains will ever prove sufficiently attractive; but to those of a philosophic turn, and more especially to the botanical and geological student, it will be still more so, from the opportunity it affords of witnessing, during the ascent, the rapid transition from the warm region of stately forests round their base, to the middle zone of dwarfish evergreens higher up, and the bleak, dark hued and utterly shrubless chaos of scattered rocks, extending at least one-third of the distance to the summit; and he will not be the less surprised to find that, instead of any portion of these rocks being *in situ*, the whole consists of dislocated fragments of every size and form, and in every position, as if the upper portion of the mountain had been upheaved, or rather exploded into the air by some internal force, and the shattered materials had been again deposited in utter confusion, where they now lie.†

The general structure of these fragments is a kind of stratified granite, in many instances passing into micaceous schist, of a very brilliant appearance in the fresh fracture, but where weather-beaten, generally vested with crisp short lichens, imparting a dark gloomy character to the whole scene. To this, however, there are some marked exceptions as in is two venerable spurs of the mountain about half way up, the bare rough surface of which has an imposing hoary aspect, distinct from all the rest, arising perhaps from some extra material producing a more rapid decomposition or disintegration of the superabundant Felspar. But to enable me to know more on this point hereafter, I have brought away a few interesting specimens, to be submitted to the inspection of more scientific friends. Being at the time disposed to attribute the convulsive force alluded to to volcanic action, I looked narrowly round in every direction for some indications of traps, but without success.‡

* One solitary tourist had ventured to attempt the ascent of the Mountain this morning, but was obliged to retreat, after having accomplished two-thirds of his weary pilgrimage, for fear of being blown away.

† For the mere tourist, Summer is, of course, the best season. For the more philosophic admirers of nature, the many-tinted Autumn is to be preferred.

‡ Note.—Since the above was in type, the writer had very unexpectedly an opportunity of submitting these specimens to the scientific inspection of Mr. Logan, whose remarks upon them are as follows:—"The specimens from Mount Washington are all granitic, being composed of quartz, feldspar and mica. The constituents are generally so arranged as to give the rocks from which they come a gneissoid

To complete this rambling retrospective memorandum, it is proper to add that the patriotism of our American neighbours has progressively given distinctive names to the principal peaks or summits of this Alpine region, derived from successive Presidents and other celebrated statesmen, as will be further mentioned; but that the appropriate appellation usually assigned to them by the Indians is said to be Waumbecthet Methna, signifying "the mountains of the snowy foreheads," and that the whole range is by them regarded as the abode of Genii, or Guardian Spirits, having the controul of the angry mountain tempests, whom it is advisable to propitiate by sacrifices. The name is in all probability derived from their summits being generally clothed with snow about nine months in the year; but it is also possible that both that and the appellation bestowed by Europeans may be derived from certain remarkable mountains of the group, noticed by all passing travellers as retaining a naked, hoary aspect throughout the whole year, similar to the two lower spurs of Mount Washington above described.

The height of the principal summits of the White Mountains above the sea has been determined by the scientific observations of W. A. Goodwin, Esq., to be as follows:—

Mount Washington .... 6285 feet.
" Adams .... 5790 "
" Jefferson .... 5710 "
and Mount Madison .... 5361 "

and that of others, by previous measurements, as follows:—

Mount Munro .... 5349 feet.
" Clay .... 5011 "
" Franklin .... 4850 "
and Mount Clinton .... 4200 "

besides Mount Pleasant, 4715 feet, and several other peaks exceeding 3000 feet, such as Mounts Moriah, Webster, Crawford, &c.

The climate of this elevated region of course differs materially from the plains below. The greatest heat indicated on even the bare, rocky summit of Mount Washington, is said to be seldom above 60°. The greatest cold has not, I believe, been yet ascertained. At times during the summer the thermometer descends below the freezing point. As for instance, a week ago it was, at sunrise, as low as 31°; and on the morning of our visit it was said to have been the same, whereas at sunset it stood at 42 , and continued so till next morning, when we commenced our descent; and I afterwards learnt that it only rose seven degrees higher during the day. By a memorandum which I found taken of the range of the thermometer from the 21st to the 27th Aug., inclusive, it would appear that it was as follows:—

DATE.	Sunrise.	Noon.	Sunset.	REMARKS.
August 21	36	46	45	To give correct mean, the middle observation ought to have been taken at 2 P.M., instead of at Noon, and the evening observation at 10 P.M.
" 22	39	41	35	
" 23	33	43	42	
" 24	37	46	45	
" 25	44	42	36	
" 26	31	47	42	
" 27	42	47	49	

It may be added that the whole is perhaps rated a little too high, the thermometer being placed within a few inches of the outside of the glazed window of a warm kitchen, and therefore liable to be more or less influenced thereby. Our landlord, however, insisted that it had been proved that such was not the case.

It only remains to observe that, to enjoy as much as possible of the grand and imposing scenery of the White Mountains, it is advisable not to take any luggage to the Glen-House, but either to leave it at the Gorham Hotel, or send it on to Sherbrooke, and thereby leave the tourist at liberty to descend Mount Washington by some new route, such as by the Great Notch, a stupendous narrow rocky portal or chasm between the steep sides of Mount Webster and Mount Willard, near which there is a convenient Hotel kept by Mr. Gibbs; or, by taking pains to enquire beforehand, he can select some other equally inviting and interesting route, taking care, if time be an object, to arrive at the Gorham station in proper season to rejoin the passing cars.

For the benefit of those who study economy in their movements, it may be proper to note, that the usual expense at the Gorham House is $1½ a day, and at the more secluded and less frequented Glen House, $2; and that at the Summit House it is $3; and that, too, is a reasonable charge, considering that every article of consumption, including even wood and coal for a constant fire, is obliged to be brought up on horseback, from below; but it is at the same time necessary to be "pretty much" on one's guard against *extras*, as "they contrive to stick it on at an awful rate," whenever an opportunity offers. The usual coach fare from the Gorham to the Glen House is 75 cents; and that of a horse per day for ascending Mount Washington is $3.

It may also be here added, that the existence of two hotels on the bleak, solitary summit of Mount Washington, though perhaps beneficial to the public, furnishes an opportune illustration of the reckless go-ahead competition common among our American neighbours; it having no sooner been understood that the original enterprising proprietor of the "Summit House" establishment had made a tolerably good speculation out of it, than up starts another competitor this year, in our neighbour of the "Tip-Top House,"—who, not content with taking the hard-earned morsel out of his rival's mouth, was resolved to usurp his very name and title also, which, it appears, last year rejoiced in the double cognomen of "The Tip-Top, or Summit House." This, however, was too much; and was likely to have produced a serious "blow up;" but it was at last amicably settled, by its being agreed that the elder occupant should retain an undisputed right to the title of the Summit House, and that his junior might assume that of the Tip-Top, or any other higher rank that he pleased. And "*Tip-Top House*," is therefore, now, proudly blazoned on his inviting sign-board. It would appear, however, that a discerning public, respecting the rights of primogeniture, or primo "*entemps*," are determined to continue their patronage to the original enterprizing caterer for their comforts,—for a personal inspection of their respective guest-books, exhibits a flood of no less than 2200 visitors to the Summit House during the season, of whom 16 only were from Canada, while at the other, though intended to be the tip-top of the fashion, as well as of the mountain, the number was as yet not more than 300. So much for unnecessary rivalship.

VALE.

character. They are probably metamorphic. The crystals in one or two, however, are confused aggregate; and these are perhaps derived from granite veins. Some of the specimens hold black tourmaline or schorl, and small pink garnets. The specimens from the two remarkable white looking heights observed in the descent from Mount Washington, appear to be true granite. They are composed of opaque, white feldspar, in a state of partial decomposition, colourless, transparent quartz, and silvery mica; and the mass of rock from which they are derived is probably intrusive."

Variations in the Level of the Lakes.*

The year 1819 was one of low water on all the lakes, the low-

* Continued from page 25.

est, indeed, in memory, and was taken by Dr. Houghton† as his zero of comparison; referred to this zero, the highest level of Lake Michigan was,—

	Ft.	In.
In 1819	0	0
1830	2	0
1836	3	8
1837	4	3
1838	5	3
1839	3	11
1840	2	7½

Thus, it was 19 years in attaining its maximum, but only 2½ in reducing it to one-half. The following variations in the level of Lake Erie, in 1852, were recorded by C. Whittlesey, Esq., of Cleveland‡:—

	Monthly Mean. Ft.	In.
January	3	6
February	3	4.2
March	2	11.6
April	1	11.3
May	1	4.0
June	1	1.2
July	1	2.5
August	1	5.1
September	1	9.4
October	2	0.6
November	2	3.3
December	2	4.1

Capt. H. T. Spencer, recorded the variations in the level of Lake Ontario, at the mouth of the Genesee, during the years 1846—1852, both inclusive; they are as follow:

	1846.		1847.		1848.		1849.		1850.		1851.		1852.	
	ft.	in.	ft.	in.	ft.	in	ft.	in.	ft.	in.	ft.	in.	ft.	in.
January 1	3	3	3	0	1	5	3	2	2	9	2	8	3	3
February 1	3	6	2	5	1	10	3	2	2	4	3	6	3	3
March 1	3	0	2	0	2	7	3	4	2	4	3	0	3	0
April 1	2	9	2	0	2	2	2	10	2	4	2	11	2	8
May 1	2	6	1	5	2	2	2	0	1	8	2	8	1	2
June 1	2	3	1	1	2	1	1	9	1	5	2	2	1	2
July 1	2	3	1	1	2	2	2	8	1	10	1	11	0	10
August 1	2	6	1	1	2	3	2	3	2	10	2	2	1	0
September	2	9	2	0	2	8	2	9	2	11	2	6	1	6
October	2	9	2	3	3	1	2	2	3	4	2	11	0	11
November 1	3	0	2	7	3	6	2	2	3	7	3	5	2	2
December 1	2	9	2	10	3	5	2	5	2	7	3	3	1	10
" 31	3	0	1	5	3	2	2	9	2	8	3	8	1	11
Average	2	0	1	11	2	6	2	6½	2	6	2	9½	1	11

The measures were taken from the top of the dock, and reduced to one point of observation. Of course the less the measure, the higher the level of the water of the lake. The highest was in July, 1852, and the lowest in November, 1850; the difference being two feet nine inches.

In continuation of the table of observations by Mr. Stewart, given on page 27 of the last number of this journal, we append those for September and part of October. The present gradual fall of the water is very evident; but if we may reason from the very crude and imperfect observations which we have been able to procure, it will soon become stationary and remain so until it begins again to rise in the spring. The greatest height recently attained by Lake Ontario above the low water mark of October 28, 1849, is four feet five inches, according to measurements made at Toronto. Since June 1st of the present year, it has fallen in four months and fifteen days only twenty-one inches; whereas in 1849, the water fell in three months and twenty days, twenty six inches.

Observations made at Gorrie's Wharf by Mr. G. A. Stewart, 1853:

September.				October.			
Day.	Hour.	Height of Water.	Wind.	Day.	Hour.	Height of Water.	Wind.
7	10 A.M.	3.28	....	1	3 P. M.	3.37	S.W.
8	12 Noon	3.35	W	3	11 A. M.	3.17	N.W.
10	12 Noon	3.28	W	6	3 P. M.	3.06	N.W.
16	11 A.M.	3.40	W	7	5 P. M.	3.20	S.W.
20	12 Noon	3.50	....	8	3 P. M.	3.20	S.W.
24	11½ A.M	3.32	W	15	3 P. M.	2.98	
26	4 P. M.	3.42	E				
27	12 Noon	3.32	E				
29	11 Noon	3.40	S.E.				

Among the most interesting phenomena which may be classed under variations in the level of the lakes, are the sudden elevations and depressions which have been recorded from time to time as occurring chiefly on the shores of Canada and the State of New York. It is much to be regretted that accurate observations of these fluctuations do not appear to have been made. The data at our command are exceedingly meagre, and scarcely do justice to the very interesting phenomena to which they refer.

In a communication to the *Cobourg Star*, dated Grafton, Jan. 9, 1847, the writer, Mr. Thomas Thompson, states that "A most singular phenomenon occurred at this place (Grafton) yesterday afternoon, about three o'clock. The lake was calm, and the wind in the north, when suddenly the lake receded from the shore in one immense wave upwards of 350 feet, leaving the the beach perfectly dry for that distance; it seemed to gather itself into a vast cone, and immediately returned in one unbroken wave, four feet higher than it usually is, burying the wharf completely, and overflowing its usual boundaries upwards of a hundred yards, sweeping everything before it, accompanied by a dreadful noise. This happened eight or nine different times, gradually decreasing in violence, until the lake assumed its natural appearance." The effects of this disturbance were felt as far as Port Hope unaccompanied by any noise.

The same paper records another disturbance as having taken place in Rice Lake, twelve miles north of the town of Cobourg. "Last Thursday, (January 14, 1847,) the lake was seen to be in great commotion, the ice (81 inches thick,) undulating in every direction. Presently it burst with a noise like thunder, and a

† Report of the State Geologist, Michigan, 1841, p. 162.

‡ Extracted from the Regent's Report for 1853.

large piece from the centre of the lake was for a few minutes thrown up in a pile to the height of ten feet, in which position it now lies."

On September 20th, 1845, a very sudden rise occurred at Cobourg. An eye-witness describes the scene in the following words :—"I measured the rise of water at the time, and found it to be two feet seven inches; the lake was quite calm; a strong current, like a tide, ran in and out of the harbour every ten minutes; when the water approached the shore it ran no less than 300 feet up the sloping beach above our usual high water mark. About the same time a similar phenomenon was observed at Grafton, seven miles below Cobourg, but with this difference, the water a few hundred feet from the shore was boiling as you see it in the lesser rapids of the St. Lawrence. When stationed at Whitby Harbour, some years ago, I observed a regular tide rising and falling every ten minutes in a pretty strong current. I have been a good deal on the back lakes, but never observed anything of the kind there."

The 5th July, 1850, witnessed a similar occurrence on the northern shore of Lake Ontario, near the scene of the other convulsions mentioned above.

Robert Stephenson, M. P.*

The Britannia Bridge has usually been considered as the greatest triumph of Engineering skill in existence, and as eclipsing all other of Stephenson's works; in originality and boldness of conception, this is doubtless the case, but we doubt whether, in wonderful results, and in their effects on the progress of the world, it can at all be compared with the "ROCKET;" the result of the determination recorded in our last paragraph, and of which so little is popularly known that our American neighbours have claimed the honours of the Liverpool and Manchester competition in 1829, for Ericson, while many of his own countrymen are ignorant as to whether the success was due to Robert Stephenson or to his Father.

In the Locomotive, as in other machines which have received improvements from various persons, it is difficult—often impossible—to determire the exact amount of merit due to each individual improver, but of this there can be no doubt: to Robert Stephenson belongs the merit of combining and arranging principles—many of which were, without doubt, previously known—into such a form that no essential change in the machine has since been made. As Watt perfected all that is unchangeable in the Stationary Condensing Engine, so did Robert Stephenson combine in the Rocket all the *fixed* principles which obtain in the construction of the most finished and most powerful Locomotive of the present day. Others have contributed to that success, and we believe no one is more ready to acknowledge their merits than is the inventor of the "*Rocket.*"

We have already seen that Trevithick had used the blast pipe, and that Harkworth had subsequently applied it, but its value was of little importance with boilers as constructed by them. Another improvement, however, patented by a French Engineer in 1828, although vital to the success of the machine, was of no value withou it.

*Continued from page 40.

The imperfect Locomotives of that date had been introduced into France; the first two were made by George Stephenson, and arrived there in 1829, for the Lyons and St. Etienne Railway, of which M. Siguin was Engineer. Their mean velocity did not exceed 4 miles per hour; to increase this, M. Siguin felt the necessity of increasing the evaporating power of his boiler, and to effect that object resolved to apply the improvement above alluded to, of which he was the patentee, to an Engine he was about constructing (on the model of Stephenson's). His plan consisted in dividing the current of heated air passing through the boiler from the furnace to the chimney, into a number of streamlets, flowing through a series of tubes immersed in the water of the boiler. The amount of heating surface was thus greatly increased. But another difficulty presented itself : the evaporating surface to which we are indebted for our present increased speed was there, but the friction of the air passing through so many small tubes so much impeded the draft that the height of the chimney being unavoidably limited, it became necessary to apply a fan to stimulate it; by this expedient the experiment was rendered partially successful. It is claimed by a French Author that M. Pelletin suggested the application of the steam jet in the chimney; be that as it may, it had long been used in England, though for the reason above named, only partially so, as might be inferred by its absence in the Engines sent to France.

As the success of the Rocket has been considered the commencement of the era of successful steam Locomotion, a description of that Engine, of the others which entered into competition with it, and of the result of the several trials, will not be out of place, we therefore transfer the following particulars of them to our pages:—

Three Locomotives were put in for competition, viz:

Engine.		*Make.*
Rocket,	by	R. Stephenson, Newcastle.
Sanspariel	by	Timothy Hackworth, of Thildon.
Novelty,	by	Braithwaite & Ericcson, London.*

The Rocket was the first locomotive made in England with multitubular boilers. They were adopted by Robert Stephenson, at the suggestion of Mr. Booth, then Secretary of the Liverpool and Manchester line, to whom their invention has commonly been ascribed. The boiler was cylindrical with flat ends, 6 feet long, and 3 feet 4 inches in diameter; the fire-box, at the rear of the engine, was 2 feet by 3 feet broad, and 3 feet deep, inside measure, and was surrounded on the two sides, the front and the top by an external case, affording a three-inch water space. The flue consisted of 25 tubes, 3 inches diameter ; the cylinders, two in number, placed obliquely next the fire-box, and working the fore-wheels, were 8 inch by 16½ inch stroke; driving-wheels 4 feet 8½ inches in diameter; the exhaust pipes were originally arranged to deliver the steam directly into the atmosphere, under the impression, no doubt, that the abundance of heating surface unaided would have commanded an abundance of steam.

After some preliminary trials, however, previous to the competition, during which the superior evaporating powers of the Sanspareil, with a sharp blast from the exhaust directed upwards into the chimney, became apparent, it was resolved to discharge the exhaust steam of the Rocket into the chimney, and on the eve of the first day of the trial the exhaust-pipes were diverted into the chimney, with an upward termination. The fire-grate surface was 6 feet, fire-box surface 20 feet, tube surface 117.75 feet.

* Engravings of these Engines will appear in the next number of the *Journal*.

The Sanspareil had a cylindrical boiler 4 feet 2 inches diameter, and 6 feet long. The grate and chimney were situated at one end of the boiler, and connected by a single flue tube, with one bend, 24 inches in diameter at the grate, and 15 inches at the chimney. The grate was five feet long by two feet broad, and was overhung by the boiler by the addition of semicircular water chambers. The steam was thrown into the chimney to stimulate the draft by means of the blast-pipe as already applied to the Royal George. The violence of the draft so produced became very evident during the experiments, The two cylinders 7 inches by 18 inches stroke, were placed vertically over one pair of wheels, and the four wheels were 4½ feet diameter, coupled. The grate surface was 10 feet; fire-box surface 15.7 feet, and tube surface 74.6 feet.

The Novelty was peculiarly constructed. The fire-box was like that of the Rocket, placed at one end, inveloped in the water of the boiler; it was 18 inches diameter, close at the bottom, and fed through an air tight hopper. The flue was a single tube 4 inches diameter at the fire-box, 3 inches at the chimney, and 36 feet long, traversing the boiler three times. The fire was urged by bellows situated near the chimney. The engine had but one cylinder, 6 inches by 12 inches stroke; placed vertically, and driving one pair of wheels, 4½ feet in diameter, by means of bell cranks. The steam was exhausted directly into the atmosphere. Grate surface 1.8 feet; fire box surface 9.5 feet; tube surface 95 feet.

The respective weights of these Engines and their loads in working order, were as follows:—

	TONS.	CWT.	QRS.	LBS.	TONS.	CWT.	QRS.	LBS.
Rocket Engine weight					4	5	0	0
Tender	3	4	0	2				
Two loaded Carriages	9	10	3	26				
Drawn weight					12	15	0	0
Total weight of Train					17	0	0	0

	TONS.	CWT.	QRS.	LBS.	TONS.	CWT.	QRS.	LBS.
Sanspareil Engine weight					4	15	2	0
Tender	3	6	3	0				
Three loaded Carriages	10	19	3	0				
D.awn weight					14	6	2	0
Total weight of Train					19	2	0	0

	TONS.	CWT.	QRS.	LBS.	TONS.	CWT.	QRS.	LBS.
Novelty Engine, weight, exclusive, of Tank					3	1	0	0
Tank loaded	0	16	0	14				
Two loaded Carriages	6	17	0	0				
Drawn weight					8	13	0	14
Total weight of Train					10	14	0	14

The Drawn Weights attached to the Rocket and the Sanspareil, were the regulation loads—three times the weight of the engines,—as the Novelty had no Tender, the same carrying weight was assigned to it in proportion the exclusive weight of the engine that existed in the experiment with the Rocket.

The Rocket was the only engine that accomplished the distance of 70 miles. Its average speed was 13.8 miles per hour the greatest volocity in any one trip was 29 miles per hour. The consumption of Coke per mile per ton of total load of Train was 0.91 ℔s., and per cubic foot of water evaporated 11.9 ℔s., the evaporation, 18.24 cubic feet of water per hour."

"The Sanspareil ran a distance of 27.5 miles, average speed, 14 miles; greatest speed, 22.6 miles; Consumption of Coke per ton per mile of total load, 2.41 ℔s., and per foot of water evaporated, 28.8 ℔s.; evaporation, 24. feet of water per hour."

"The Novelty, by a series of unfortunate accidents, failed twice in the midst of experiments. The engine with its load, traversed the Stage at 15 miles per hour. * * *

* At a subsequent trial on the experimental stage, after some alterations, the engine conveyed a total average load its own weight included, of 28.5 tons, at an average speed on the stage of 8 miles per hour; the Coke consumed per hour, was 84 ℔s., during 6¼ hours, the bellows being at work during the whole of that time. The consumption was therefore, equivalent to 0.36 ℔s., per ton per mile."

These trials established the advantages of an extended flue surface, which the arrangement adopted by Mr. Stephenson, had brought into useful operation; he now set himself to make further improvements, and these he embodied in two other engines constructed on the same principle as the Rocket.

SECOND REPORT of the Special Committee of the Literary and Historical Society of Quebec, appointed to Report upon Mr. Foucault's Pendulum Experiment.

Your Committee, having undertaken to make this experiment with all the care possible, have much pleasure in submitting the following report on the results obtained by them:—

A carefully turned spherical ball of lead 5.2 inches in diameter, and weighing 17 lbs., was procured for the weight, and suspended in the passage of the "Quebec Music Hall," where a height of 60 feet was obtained. This weight was suspended by a fine steel wire 0.15 inches in diameter, on one end of this wire a fine screw was turned, by means of which the wire was fastened to the plate from which the pendulum was suspended.

The method of suspending the pendulum was similar to that adopted by your Committee in their former experiment. A small spherical ball of brass was ground into a hemisphere in a plate of the same metal; a hole was drilled through the centre of the hemisphere for the wire, and sufficiently large to allow the pendulum to vibrate in the required arc without coming into contact with the plate; the wire was secured into the ball of suspension.

This arrangement being completed, the weight was attached to the lower extremity of the wire, so as to hang within one inch of the floor.

In order to start the pendulum for the experiments, a cotton thread was passed round the ball and tied over two pins on a heavy moveable block. When the weight secured in this manner had been brought to a state of rest, the thread was fired with a taper, and the pendulum commenced vibrating, the thread falling to the ground. A circle 10 feet in diameter was described on the floor from a centre under the point of suspension, and graduated into degrees, by which the progress of the pendulum was measured.

The first experiments gave a deviation from the calculated angle of about 1°40′ an hour. This was subsequently accounted for and corrected, the wire being observed to touch the under surface of the brass plate at the extremity of each vibration. Your Committee consider this worthy of remark, as showing how slight an irregularity at the point of suspension was sufficient to produce an error that would have vitiated the whole of the experiments.

The first observations were made on the night of the 13th May, 1853, but were rejected from the cause mentioned above. The observations recorded were made on the 14th, 15th, 16th, 19th and 20th of the same month. The results are given in detail in the tables.

The first series of observations gives the angle actually moved through in 47 h. 18 m. (after applying the correction for the progression of the apse due to elliptic motion) only 1° 56′ less than that calculated. The second series gives an error of 2° 2′ in 23 h. 10 m. These errors may be represented in time by about 9 and 12 minutes, and your committee consider that these experiments agree so nearly with the calculation as to be very strong corroborative evidence of the correctness of theory that the time taken by the plane of vibration to perform a complete revolution, varies as the line of the latitude.

It may not here be out of place to give a short explanation of the accompanying tables: columns (1) & (2) refer to the times of observation: (3) denotes the nature of the ellipse showing if there be no elliptic motion, or if elliptic motion, whether it is progressing or retarding. Column (4) shows the angle observed (5) the angle moved through, (6) the time between the observations, and (7) the apparent error, (8) shows the angle corrected for elliptic motion, (9) the angle calculated, and (10) the difference+or—between the calculated angle and the corrected angle.

Your committee have great satisfaction in submitting the results of the different experiments. In some instances they have varied considerably from the calculated angles, but in all these, the fact that the pendulum had acquired a corresponding elliptic motion would seem to indicate some local cause of disturbance, while in all the experiments in which there was no elliptic motion, the angles as nearly as could be measured were equal to those calculated by theory.

The whole respectfully submitted.

A. NOBLE,
Lt. R. A. & V. P.
W. DARLING CAMPBELL.

Quebec, July 1853.

From.	To.	Ellipse.	Angle observed.	Angle moved through.	In what time.	Error.	Angle corrected.	Angle calculated.	Difference.	
1	2	3	4	5	6	7	8	9	10	
H. M. S.	H. M. S.		° ′	° ′	H. M. S.	° ′	° ′	° ′	° ′	
10 36 0	11 53 0	R.	14 45	14 45	1 17 0	+0 30	....	14 14.1	+0 30	Started N. and S.
12 3 0	2 0 30	N.	35 45	21 0	1 56 30	—0 28.6	....	21 28.6	—0 28.6	
2 0 30	3 36 0	N.	53 20	17 35	1 36 0	+0 8.3	....	17 26.7	+0 8.3	
3 36 0	4 6 0	N.	58 40	5 20	— 30 0	—0 8.9	....	5 28.9	—0 8.9	
4 17 0	5 17 0	R.	71 0	10 0	1 0 0	—0 57.7	10 50	10 57.7	—0 7.7	
5 21 0	6 21 0	R.	84 4	10 10	1 0 0	—0 47.9	11 0	10 57.9	+0 2.1	
6 24 0	7 36 0	R.	98 30	12 30	1 12 0	—0 38.1	13 0	13 8.9	—0 8.9	
7 52 0	8 53 0	N.	113 0	11 0	1 1 0	—0 8	....	11 8	—0 8	
8 53 0	11 10 0	....	136 10	23 10	2 17 0	—1 50	....	25 1	—1 50	No elliptic motion recorded.
11 20 0	4 34 0	N.	193 0	56 50	5 14 0	—0 32	....	57 22	—0 32	
4 34 0	7 22 0	P.	226 0	33 0	3 48 0	+2 45	32 20	30 16	+2 4	
7 46 0	10 30 0	N.	261 0	31 0	2 44 0	+1 46	....	29 55.4	+1 46	
10 30 0	10 40 0	N.	264 30	3 30	— 20 0	—0 8	....	3 38	—0 8	
10 57 0	12 57 0	R.	288 0	21 30	2 0 0	—0 25.8	21 52.8	21 55.8	—0 3	Ellipse ret. slightly.
2 11 0	3 11 0	R.	369 56	19 56	2 0 0	—2 0	20 56	21 55.8	—0 59.8	
3 24 0	5 38 0	R.	332 30	20 30	2 14 0	—3 56.4	21 35	24 28.6	—2 53.6	
5 56 0	9 45 0	R.	18 30	40 30	3 49 0	—1 21.2	41 25	41 51.2	—0 26.2	
10 0 0	12 0 0	R.	43 5	21 40	2 0 0	—0 15.8	21 55.8	21 55.8	....	Ellipse ret. sliightly, for which allow +15.8.
12 0 0	2 0 0	P.	66 0	22 55	2 0 0	+1 0	23 1	21 55.1	+0 45	
2 12 0	6 12 0	R.	110 30	42 30	4 0 0	—1 21.6	43 51.6	43 51.6	....	
6 33 0	11 53 0	N.	174 10	59 10	5 20 0	+0 42.5	....	58 27.5	+0 42.5	
					47 18 0	—8 8.2			—1 56.8	

From.	To.	Ellipse.	Angle observed.	Angle moved through.	In what time.	Error.	Angle corrected.	Angle calculated.	Difference.	Axes. Max.	Axes. Min.
1	2	3	4	5	6	7	8	9	10		
H. M.	H. M.		° ′	° ′	H. M.	° ′	° ′	° ′	° ′		
4 11	7 11	R.	30 46	30 46	3 0	—0 10		32 53	—2 3.5	15	⅛
7 50	9 45	R.	53 14	22 34	1 55	+1 33	22 51.3	21 1	+1 50.3	22	¼
9 55	10 44	R.	62 12	8 58	— 48	+0 1	8 58	8 57	+0 1	..	—
10 44	1 1	R	86 35	24 23	2 17	—0 39	24 44.1	25 2	—0 17.9	15	¼
1 29	2 59	R.	100 50	14 15	1 30	—2 11	15 29	16 24	—0 57	30	1
3 8	6 8	R.	129 0	28 10	3 0	—4 43	29 24	32 53	—3 29	15	1
6 20	8 50	R.	151 30	22 30	2 30	—4 54	23 29.2	27 24	—3 54.8	18	4-5
9 20	11 20	R.	172 20	20 55	2 0	—1 0	21 32.8	21 55	—0 [illegible]	23	½
11 34	2 43	P.	209 40	37 20	3 9	+2 54	36 52.8	34 30	+2 22.8	14	⅜
2 55	5 55	P.	248 0	38 20	3 0	+5 27	37 40.5	32 53	+4 47.5	16	½
					23 10	—5 45			—2 2.8		

F

Library of the Canadian Institute.

Through the liberality of A. H. Armour, Esq., of Toronto, the Library of the Canadian Institute has just received a very valuable addition to its collection of Books and Maps. The volumes presented consist of the magnificent Report of David Dale Owen, U. S. Geologist, on the "Geological Survey of Wisconsin, Iowa, and Minnesota, and incidentally of a portion of Nebraska Territory," accompanied by a quarto volume of Plates and Maps illustrative of the work. Also, of the annual Report of the Superintendent of the Coast Survey, and a quarto volume of sketches accompanying the Report. We understand that Mr. Armour is indebted to the politeness of the Hon. J. M. Brodhead, second Comptroller of the U. S. Treasury, for these valuable documents. The importance of procuring works of this character for the Library cannot be too highly estimated, and we gladly avail ourselves of the earliest opportunity of acknowledging the uniform zeal which Mr. Armour has manifested in promoting the interests of the Canadian Institute.

Twenty-Third Meeting of the British Association for the Advancement of Science.*

The following recommendations were adopted at a Meeting of the General Committee:—

Involving Grants of Money.

That the sum of £200 be placed at the disposal of the Council for the maintenance of the establishment of the Observatory at Kew.

That the Committee appointed to investigate the Physical aspect of the Moon be requested to endeavour to procure Photographs of the Moon, from telescopes of the largest size, which can be made available, with £25 at their disposal for the purpose,

That the expense of certain Thermometers constructed for the inquiry on conduction of heat, by Professor Forbes, amounting to £4 2s. be paid.

That Dr. Hodges be requested to continue his investigations on Flax, with £20 at his disposal for the purpose.

That Mr. Rankine, Dr. Robinson, Prof. Hodgkinson, and Mr. Ward, be requested to continue the Report on the Cooling of Air in Hot Climates, with £20 at their disposal for the purpose.

That Mr. Fairbairn be requested to prepare a Report on the effects of Temperature on Wrought Iron Plates, with £10 at his disposal for the purpose.

That Mr. Mallet be requested to continue his experiments on Earthquake Waves, with £50 at his disposal for the purpose.

That Dr. Lankester, Prof. Owen, and Dr. Dickie be a Committee to draw up Tables for the Registration of Periodical Phenomena, with £10 at their disposal for the purpose.

That Dr. Lankester, Prof. E Forbes, and Prof. Bell, be requested to assist Dr. T. Williams in drawing up a Report on British Annelida, with £10 at their disposal for the purpose.

That Mr. Hyndman, Mr. Patterson, Mr. Dickie, and Mr. Grainger, be requested to carry on a system of Dredging on the North and East Coasts of Ireland, £10.

That Mr. H. E. Strickland, Dr. Daubeny, Prof. Lindley, and Prof. Henslow be requested to continue their Experiments on the vitality of Seeds, with £5 10s. at their disposal for the purpose.

That the Committee for providing a large outline Map of the World, consisting of Sir R. I. Murchison, the Lord Bishop of St. Asaph and the Secretaries of the Royal Geographical and Ethnological Societies, be re-appointed with the addition of Sir James Ross and Dr. R. G. Latham, with £15 at their disposal for the purpose.

Not involving Grants of Money or Application to Government or Public Authorities.

That Lieut-Col. Portlock, Prof. James Forbes, Mr. Mallet, Mr. Phillips, Dr. Robinson, Col. Sabine, and Professor Stokes, be requested to consider and report upon the best form of apparatus for registering the direction and amount of Earthquake.

That Dr. Gladstone be requested to continue his inquiries on the influence of Light on the Vitality of Plants.

That Mr. Robert Hunt be requested to continue his investigation of the Chemical Action of the Solar Rays.

That the following gentlemen be a Committee to report on the best means of preserving Pyritous and other specimens of Organic remains which are liable to decomposition, viz.: J. S. Bowerbank, Esq., Prof. Johnston, J. E. Lee, Esq., H. E. Strickland, Esq.

That Mr. Spence Bate be requested to give a report on the present state of our knowledge of the Lower Forms of British Crustacea.

That Mr. Fairbairn's account of Experimental Researches to determine the Strength of Locomotive Boilers, and the causes which lead to explosion, be printed, entire, among the Reports.

That the Kew Committee be requested to furnish a Report to the Council, on the Definition of the Boiling Point of Water at present adopted in this country, for the Thermometric Scale; and that the Council be requested to communicate with the President and Council of the Royal Society; should any change in that respect be deemed desirable.

That Prof. Johnston be requested to furnish a Report on the relations of Chemistry to Geology.

That the following papers with the consent of the authors, be printed in full in the Transactions of the British Association for the year 1853: —James Oldham, Esq., 'On the Physical Features of the Humber.' 'On the Rise, Progress, and Present Position of Steam Navigation in Hull.' J. P. Bell, Esq., M. D., 'Observations on the Character and Measurements of Degradation of the Yorkshire Coast.'

That Mr. John Frederick Bateman, C. E., F.G.S., be requested to Report on the State of our knowledge on the Supply of Water to Towns.

That the thanks of the British Association be given to the Parliamentary Committee for the unceasing attention they have paid to the interest of Science, both in communications to Government, and in proceedings in the Houses of Parliament.

The Members of the British Association have learned with satisfaction that it is the intention of Government to direct, that in future daily Meteorological Observations shall be made at sea, in correspondence with the plan adopted by the Government of the United States, on the suggestion of Lieut. Maury, and to take such further steps, in reference to the Mercantile Marine of Great Britain, as may be best suited to stimulate and encourage the Masters of British Merchant Ships to take interest in investigations by which the times of passage between different ports have already, in many instances, been materially shortened, and which may lead to other results of the greatest importance to practical navigation.

The British Association entirely concurs in the opinion that to make the Observations thus contemplated serviceable for the purposes which they are designed, it will be necessary to make provision for their co-ordination, and for deriving from them the instruction which they may be capable of yielding, primarily for the advantage of navigation and secondarily, for the benefit of Science.

In this view the General Committee requests that the Council will communicate on the subject with the Parliamentary Committee, and will take such steps, either by deputation to Government or otherwise, as may appear to them desirable.

That Col. Sabine be requested to draw up a Report on the principal magnetic results obtained at the Magnetic Observatories.

Involving Application to Government.

That as great inconvenience is frequently occasioned by the injury or destruction of instruments and specimens, arriving from foreign parts arising from careless re-packing at the Custom House, it be referred to the Council to consider of the best mode of representing this to the Government, and of remedying the evil.

Section A.—MATHEMATICAL AND PHYSICAL SCIENCE.

Col. Sabine opened the Section by apologizing for the absence of the President.

'Continuation of Report on Luminous Meteors,' by the Rev. Professor Powell.—The Report contained tabulated records of observed meteors

*Athenæum.

classified under three general heads:—I. Older observations recorded of Luminous Meteors. II. Continuation of Catalogue of Luminous Meteors from the Report of 1851-2. III. An Appendix, containing letters and drawings, giving a more detailed account of some more Remarkable Meteors. The number of meteors tabulated under the second head was very large. The records were preserved under the following heads:—1. Date; 2. Hour and minute when seen; 3. Appearance or magnitude; 4. Brightness and Colour; 5 Train, or sparks; 6. Velocity, or duration; 7. Direction, or altitude; 8. General Remarks; 9. Place; 10 Observer; 11 Reference. This report gave rise to a very animated and long sustained conversation.

Mr. Grove explained the three opinions advanced as to the possible origin of these interesting objects. At one time it had been maintained that they were bodies projected upon the earth from the moon; next, it had been supposed that they had a chemical oirgin in our own atmosphere;—and lastly, it was held that they were probably planetary bodies whose orbits t aversing that of the earth when they met it a node, the planetary mass falling into our atmosphere ignited and put on one of the varied ph ses of a meteor. Mr Grove stated, that the first opinion was now universally abandoned;—that the second though still claiming supporters, was not considered the most probable;—and that the third opinion was all but universally now received among scientific men as the most probable account of their origin. He fortified each of these statements, giving the leading reasons which led to the rejection or adoptio nof each.

'*On the Composition and Figuring of the Specula for Reflecting Telescopes*,' *by* MR. SOLLITT.—The writer commenced by stating that he had given his attention to this subject for years, and that he was more than ever convinced of its importance by the decided conclusion to which facts had led him that reflectors, when once well and carefully made, were far less apt to deteriorate than refractors. In order to be intelligible to the Section, it was necessary for him to go over some ground familiar to the public since the researches of Lord Rosse, Mr. Lassell and Mr. Nasmith. He stated that he considered it to be a matter of prime importance that the copper and tin should be used in exact atomic proportions He, following the numbers given by Berzelius, used the following proportions—copper, 32; tin, 17·4. Lord Rosse's are, copper, 32; tin, 14 9. As the metal when thus composed was very hard, brittle, and difficult to work, he found that he could render it capable of reflecting white light equally well, if not better; and at the same time of taking a very uniform and beautiful polish, by introducing a little nickel in place of the tin,—and the following proportions he found on trial best:—copper 32; tin, 15 5; nickel, 2. He also found the introduction of a very small quantity of arsenic useful in preventing the oxidation of the tin when melting. Silver, as used by Mr. Lassell, he also found excellent; but he was against the use of fluxes, as most injurious. The author passed over the casting and grinding with very slight notice; but dwelt on the composition and figuring of the polisher as of great importance. The composition as used by him was pitch resin, and a small admixture of flour was found useful. The surface he grooved with concentric equidistant circular grooves,—and not in parallel and cross grooves, as used by Lord Rosse and Mr. Lassel.—These concentric grooves he crossed by radial grooves, widening as they receded from the centre, so as to be bounded by curved outlines. By giving proper form and dimensions to these curves the parabolic form could be most accurately given to the speculum in the process of polishing. The form of the curved outlines of these radial grooves he found should be parabolic. He concluded by stating the importance of not having the speculum too thin, and of using proper precautions in mounting and supporting it, to avoid any chance of the form being altered.

Dr. Scoresby regretted that having been in another Section he had not heard the early part of the communication of Mr. Sollitt; but he rather thought Lord Rosse used concentric grooves in his polisher as well as parallel and cross grooves. Prof. Stevelly confirmed the accuracy of this statement: and added that his memory was quite clear that Lord Rosse considered it very important to use the copper and tin in atomic proportio s, and said in his papers on it that uniformity of composition could not otherwise be hoped for. He also recognized the importance of using thick specula; the last which he had cast being not less than five inches thick He also had used and recommended resin to be used to harden the pitch and flour for a purpose by which experience he had learnt to be important. Lord Rosse had also by the several motions and adjustments which he had contrived for the speculum and the polisher reduced the figuring of the speculum to an almost certain function of time; so that after the speculum had been a certain number of hours under the action of the polisher, he was well assured that the proper figure had been attained. Professor Stevelly briefly described these motions and adjustments; and stated that the actual result was, an enormous circular disc of six-feet aperture, without crack or flaw, and of a splendid uniform polish, and reflecting light from objects of a perfectly natural tint.

'*On the Surface Temperature, and Great Currents of the North Atlantic and Northern Ocean*,' *by the* REV. DR. SCORESBY.—The author commenced by pointing out the great importance to Physical Geography of the subjects he proposed to discuss, particularly as they tended in the economy of Nature, to furnish a compensating instrumentality against the extremes of condition to which the fervid action of the vertical sun in the tropical regions, and its inferior and more oblique action in the polar regions, were calculated to reduce the surface of the earth. Our knowledge of all the currents of the ocean, with perhaps, one exception; the Gulf-stream, which had been, in its more important features, carefully examined and surveyed, and more especially in the American Coast Survey,—was derived from the comparison by navigators of the actual position of the ship as determined from time to time with its position as calculated from what sailors technically called the "dead reckoning," or the course steered, and the distance run as determined by the log, an instrument by no means perfect. The determination, however, of oceanic currents, to which the present communication referred, depends simply on induction from observation of temperature, on that mainly of the surface. Such observations, indeed, only become available under considerable differences betwixt the mean atmospheric and oceanic temperatures; and where they may seem to indicate the region from which peculiar qualities of the sea are derived, they can afford little, if any, information as to the precise direction or strength of the current so indicated, yet still the general results are found important and useful. The researches of the author embrace those in the Greenland Sea, the North, Sea, and a considerable belt across the North Atlantic. To those in the North Atlantic he wished at present to direct attention; and to a belt of it embraced within the limits of a series of passages chiefly by sailing vessels between England, or some European port, and New York. Of these passages, sixteen in number, four were performed by the author himself, and twelve supplied by an American navigator, Captain J C. Delano, an accurate scientific observer. The observations on surface temperature discussed amount to 1153, gathered from a total number of about 1400. Usually Captain Delano recorded six observations each day during the voyage, at intervals of four hours. Seven of the passages were made in the spring of the year,—two in the summer,—one in autumn,—and three in winter. Taking the middle day of each passage the mean day at sea was found to be May 18th or 19th,—a day fortunately coincident in singular nearness with the probable time of the mean annual oceanic temperature. The author had laid down the tracks of the ship in each of the voyages on a chart of Mercator's projection, and the principal observations on Surface Temperature were marked in their respective places. The observations were then tabulated for meridians of 2° in breadth, from Cape Clear, longitude 10° W., to the eastern point of Long Island, longitude 72°W.,—embracing a belt of the average breadth of 2.0 miles on a stretch of about 2,600 miles across the Atlantic. The results were the following:—1. Highest Surface Temperature northward of latitude 40°, 74°; lowest 32°; range 39°—Mean Surface Temperature, as derived from the means of each meridional section 56°, whilst the mean atmospheric temperature for the corresponding period was 54°·2—3. Range of Surface Temperature within each meridional section of 2°, 8½° at the lowest, being in longitude 20-22° W., and at the greatest 36°, being within the meridian of 62 64°W.—4. Up to longitude 40° the Surface Temperature never descended below 50°;—the average lowest of the sixteen meredional sections being 51°·88, and the average range being 11°·3. 5. In the succeeding fifteen sections, where the lowest temperature was 32°, the average lowest was 37°·1, and the average range 29°·7. This remarkable difference in the Temperature of the eastern and western halves of the Atlantic passage, the author said was conclusively indicative of great ocean currents yielding a mean depression of the lowest meridional temperature from 51°·88 to 37°·1, or 14°·8 and producing a mean range of the extreme of temperature on the western side of almost thrice the amount of the extremes on the eastern side,—or, more strictly, in the proportion of 29°.7 to 11° 3. The author drew attention to a diagram which he had laid down along the entire belt curves showing the whole range of the lowest depressions of temperature and highest elevation, with the means at each longitude distinguished by different shading, and pointed out how the inspection of this as well as of the tabulated results afforded striking indication of the two great currents, one descending from the Polar, the other ascending from the Tropical regions, with their characteristic changes of cold and heat. In classifying the results, the author considered the entire belt of the Atlantic track of the passages as divided into six divisions of 10° of longitude each, and these into meridional stripes of 2° each, omitting the two first degrees next the European end, or about 80 miles westward of Ireland

to 72° W., or about the same distance West of New York. To each of these six divisions he directed attention, pointing out the conclusions to be derived from each. The curves approaching each other and running nearly parallel through the western half with great regularity, showing the variations and range to be much less, while throughout the eastern half the widening of the distance, and the irregular form of the extreme curves showed the influences of the two currents very remarkably. The author then proceeded to draw conclusions, showing that sometimes the cold current from the north plunged beneath the warmer current from the south. Sometimes they divided,—the colder keeping in shore along the American coast, the other keeping out and forming the main Gulf-stream. Sometimes where they met they interlaced in alternating stripes of hot and cold water; sometimes their meeting caused a deflexion,—as, where one branch of the Gulf-stream was sent down to the south-east of Europe and north of Africa and another branch sent up past the British Islands to Norway and Scandinavia by the the Polar current setting down to the east of Newfoundland. The author next proceeded to consider the uses in the economy of nature of these great oceanic currents. The first that he noticed was the equalizing and ameliorating influence which they exercised on the temperature of many countries. Of this he gave several examples. Thus, our own country, though usually spoken of as a very variable climate, was subject to far less variations of range of temperature than many others in similar latitudes,—which was chiefly from the general influence of the northern branch of the Gulf-stream setting up past these islands. He had himself on one occasion in the month of November known the temperature to rise no less than 52° in forty-eight hours,—have previously descended in a very few days through a still greater range; while in these countries the extensive range between mean summer and winter temperature scarcely in any instance exceeds 27°, and in many places does not amount to nearly as much. Another advantage derived from these currents was, a reciprocation of the waters of high and low latitudes,—thus, tending to preserve a useful equallizing of the saltness of the waters, which otherwise by evaporation in low latitudes would soon become too salt to perform its intended function. Next he pointed out their use in forming sand-banks, which became highly beneficial as extensive fields for the maintenance of various species of the tinny tribes, as in the great banks of Newfoundland. Next, this commingling of the waters of several regions tended to change and renew from time to time the soil of these banks,—which, like manuring and working our fields, was found to be necessary for preserving these extensive pastures for the fish. Lastly, by bringing down from Polar regions the enormous masses of ice, which under the name of icebergs, were at times found to be setting down towards Tropical regions, they tend at the same time to ameliorate the great heats of those regions, and to prevent the Polar regions from becoming blocked up with accumulating mountains of ice which, but for this provision, would soon be pushed down as extensive glaciers, rendering whole tracts of our temperate zones uninhabitable wilds. Dr. Scoresby concluded by pointing out several meteorological influences of these currents, by causing extensive fogs or winds more or less violent.

'*On Dynamical Sequences in Kosmos*,' by W. J. M. Waterson.—The Dynamic theory of Heat, if accepted as being inductively demonstrated, seems to supply us with a valuable standard of physical causation that in the course of time must have an important influence on the progress of science. That some such standard has hitherto been wanting, seems to be proved by the barren results of the most eminent mathematicians, when directed to molecular physics, offering as they do so great a contrast to the success achieved in the fields of Astronomy. In these reunions of the British Association, it may not perhaps be considered out of place, or as an illegitimate course of inquiry, to assume the theory as proven, and endeavour to realize, as far as our lights at present extend, the conditions and the sequence of action, implied by its existence as a general principle throughout nature. The evidence that supports the theory equally supports many views of natural phenomena that are obviously dependant upon it as corollaries, and which ought therefore to be always associated with it. Among these I would beg attention to a few that seem specially to demand notice at the present stage of our progress. I.—Equilibrium and Sequence of Temperature in relation to a centripetal force.—*The dynamic theory of heat requires that the law of vertical equilibrium of temperature should be different from the law of horizontal equilibrium.* In whatever way conduction may be effected, equilibrium of temperature is by the theory equilibrium of force: maintained by a constant interchange of equal action or impulse between adjacent molecules, in a state of activity. The interchange may take place by direct contact or through an intermedium affected by and capable of affecting the active state of the molecules. In either case, the vertically resolved portion of this active state must be influenced by the centripetal force of the planet which tends to increase a downward impulse and diminish an upward impulse. Thus, the condition of motion once admitted, involves a greater intensity at the lower aspect of a molecular orbit than at its upper, caused by the force of gravitation acting in the interval, which must thus establish a gradient of increasing temperature towards the centre, as the natural condition of a vertical equilibrium. An increasing temperature below the surface of the earth being a recognized fact, it is possible that the condition of permanent equilibrium in our planet is already attained; and if in any mathematical speculations on the interior condition of our globe, we assume that conduction takes place the same in all directions, vertical as well as horizontal, we shall certainly be proceeding on a false assumption if the theory is correct. A vertical gradient of temperature in the atmosphere is another recognized fact impossible to reconcile with any previous theory, but is completely in accordance with these dynamic views, that if we merely assume the molecules of air to be free elastic projectiles, we can deduce its actual numerical value from the specific gravity of the component gases. From this hypothesis, too, all the physical properties of gases may be mathematically deduced. The relation that must subsist between heat and gravitation is extremely interesting, and deserves to be enlarged upon. It is in perfect conformity with the views generally entertained of the progressive formation of the solar system—the nebular hypothesis of La Place. The dynamical sequence may be illustrated as follows. Suppose a 32lb cannon ball to descend through the earth's radius under the influence of the same force of gravity as exists on the surface, the velocity acquired is 36,700 feet per second, or about seven miles. This is the same velocity as the ball would acquire in descending from an infinite height to the surface of the earth. Considering the ball as an ærolite encountering the atmosphere or earth's surface with this velocity, we are now enabled to compute the amount of heat generated by the concussion. 32lb. of water falling through a height of about 673 feet obtains an increase of 1° by the concussion, 32lb. of iron about 9°. The concussion due to the velocity of seven miles per second would generate heat enough to raise the temperature of the ball 280,000 degrees. In the same way it may be computed that if the ball descended to the surface of the sun, it would acquire a velocity of 545 miles per second, and the heat equivalent of the concussion is 1,800 million degrees. We may thus obtain an idea of the vast evolution of heat that might be caused by the process of central aggregation of matter under the influence of its gravitating energy; nor does it seem necessary to look further for the origin or continuance either of the solar heat or for that of the interior of our planet. While gravitation thus generates heat centripetally, radiation may be viewed as the escape of *vis viva* centrifugally. The modes of central collocation and of dispersion are equally mysterious: further than that, they appear as parts of a dynamical cycle. While a body is falling towards the sun, *vis viva* is generated in certain parts of space, and conveyed to the centre by the body whose molecules move together in the passage downwards. The shock at the centre puts an end to this species of motion, but generates another apparently of a vibratory kind in the molecular elements, which has the effect of awakening a radiating power through space; or what may be viewed as a centrifugal transference of *vis viva* into the regions of space. When this *vis viva* generated in space is inevitably carried to a centre before it is thus re-issued, we have the residual phenomenon of a central body augmented in mass by the process. The physical circle would be complete if this central body had a motion through space which brought it in contact with another; both, it may be, exhausted of their central *vis viva*, the shock might be supposed capable of dispersing and projecting the component part so far from the common centre of gravity as to renew the original nebulous form. In M. Pouillet's researches (Taylor's 'Scient. Mem.' vol. iv.) we have a striking view of the extreme slowness of the process of radiation from the sun. Making use of the same data, and converting the equivalent of solar radiation into quantity of matter of the density of water falling to the sun from remote regions, we may see by a little calculation that the qantity required in one year would cover its whole surface to the depth of 14[illegible] feet. Thus, the sun may be supplied with heat by the mere descent of matter as aerolites to its surface. When such bodies encounter our atmosphere, we have experience of the dazzling appearances of ignition or combustion manifested, and may judge of the effects of a continued shower of such bodies sufficient to cover the surface to a sensible depth. Each meteor signals an accession to the earth's mass, and brings also an accession of heat. If the united mass of all such meteors that impinge on our planet throughout one year were made visible to us as one aerolite descending at regular yearly intervals, there is little doubt it would suggest to the mind of the most careless observer the probability of the earth growing in size by such periodical contributions. The geologist, accustomed to the consideration of vast periods of time, might speculate on the possibility of it having thus materially increased in dimensions while the abode of organic life, without in the

least disturbing it. From what is already known, we can predicate that a ball of iron entering the atmosphere with a velocity af six or seven miles a second would instantly be melted, burnt, and converted into a red powder, and that before reaching the earth it would probably be scattered by the aerial currents into comparatively so vast an area as never to be afterwards noticed. If we suppose the mechanical force produced by the condensation of the nebulous mass from which a planet is forming to be slower than the equivalent of radiation from the same, it would seem as if there could be no great internal heat; but it is to be remembered that the vertical law of conduction requires an increase of temperature downwards, so that if a planetary mass were exposed perfectly cold to the sun's rays, it must continue to absorb heat until that vertical equilibrium of temperature had been attained:—the centripetal energy enabling it to imbibe a quantity of heat vastly greater than the surface temperature would seem to indicate. In respect to extra-terrestial bodies such subterranean heat is latent. With regard to the sun, on the other hand, the mechanical force generated centripetally must originally have far exceeded the equivalent of radiation. If its present condition is stationary in respect to temperature, its mass must be increasing. If its mass is not increasing, its temperature must be diminishing, the annual loss being represented by about 1·54 millionth of its mass lowered 1,800 million of degrees, per annum, supposing it to have the specified heat of iron: supposing, also that it does not contract or become further condensed, because this would of itself engender *vis viva*. It may be shown that so small an increase of density as would diminish the sun's diameter 860 feet represents the equivalent of the annual radiation. In the bodies that surround us, we remark that cooling and contraction are generally simultaneous. If such is the case in the sun, 33 degrees must be too high an estimate of the yearly loss of temperature. The ratio between the diminution of bulk and of temperature, were it known in the case of the sun, would enable us to compare their mechanical equivalents. The *vis viva* produced by the diminution of bulk would be classed with the phenomena of what is called latent heat in liquids, solids and gases. It would seem from these computations, which rest upon M. Pouillet's data, that the probable annual loss of temperature in the sun is by no means inconsiderable in absolute amount, but its relative value in respect to the temperature of the sun may be, and probably is quite insignificant. Is there any way of arriving at an estimate of the temperature of the sun's radiating surface? Let us consider what meaning is to be given to the expression "temperature of space," occasionally to be met with in the writings of physicists. If heat is the motion of the elementary parts of bodies, and not a subtle species of matter, as certain phenomena of latent heat seem to have suggested the idea, it is hardly correct to speak of vacant space as having a temperature, although the heat force may in various directions and with various intensities be radiating through it. In the same way, space is not considered as luminous, although traversed by most intense light. A thermometer placed in a perfect vacuum although it shows the same temperature as the substance that incloses the vacuum, actually exhibits the effect of the intensity of the heat radiations that are passing through it. If we suppose a thermometer situated at the opposite point of the earth's orbit, and subject to the influence of the sun's rays only, it would no doubt rise until the radiation from its surface amounted to what was radiated into its surface; but the temperature indicated by it cannot be accepted either as constant, for it depends on the specific radiating and absorbing qualities of the thermometer; or as affording the means of deducing the sun's temperature, for we are ignorant of the relation between temperature and the rate of emission, also of the absolute value of any given temperature unless we deduce it from the dynamic theory of gases which represents the zero of gaseous tension (—461° Fahr.) as the absolute zero of heat. If the thermometer thus isolated, is supposed to be surrounded, on all sides but the one exposed to the sun, by matter that is kept artificially heated up, to within a few degrees of the temperature shown by the thermometer, it is impossible that it could receive an accession of heat from any other source but the sun; and it seems obvious that when at last it became stationary, the temperature is one that must be independent of any specific quality of the thermometer or its artificially heated envelope, but dependent entirely on the distance and temperature of the sun. Some years ago I made an attempt to imitate the conditions of this hypothetical experiment by inclosing a thermometer within three concentric boxes well protected from external influences, and capable of being equally heated all round to any temperature below 400° Fahr. by means of flues ascending from an Argand lamp. The rays of the sun when near the meridian, (within the Tropics) were admitted to fall when required on the bulb of a thermometer through a triple glass partition. Before applying the lamp, the temperature of the interior of the box being t, a rise of about 50° took place by exposing the bulb to the sun; when the thermometer had become stationary at $t + 50°$ the sun's rays were excluded and the lamp applied to heat the box to $t +$ 50°. When the temperature was again stationary at this point, the sun was re-admitted upon the thermometer, which again rose 50° or until the temperature was $t + 100°$. The same operations were repeated up to 250°, but without any diminution of the step 50° which seemed to be made with the same alacrity at the higher as at the lower temperature. I had hoped to have detected some very obvious difference, and from its amount to infer the value of the limiting temperature that expressed the sun's power at the earth's distance. I should then have added 460° to this temperature to obtain its absolute value, then increase this in the inverse ratio of the square of the distance from the sun's centre, obtain an approximate value of the sun's temperature. It seemed to me at the time that this experiment, though not made with sufficient means, or perhaps, care to insure much accuracy, proved that the intrinsic force of the sun's rays of heat was much greater than might be inferred from the temperature of the atmosphere. I purpose at a future opportunity to consider the Dynamical Sequence of Latent Heat and Molecular Force.

Mr. Hopkins addressed the Section, pointing out the important hints and valuable lines of inquiry which the paper suggested; but also showing with what caution it was to be be received in many parts as statements of determined scientific truth.

Section B.—CHEMICAL SCIENCE.

'*On the Chemical Action of the Solar Radiations*,' by Mr. R. Hunt.—This was a report to the section of the continuation of an examination of the chemical action of the prismatic spectrum, after it had been subjected to the absorptive influences of different coloured media. The mode of examination has been to obtain well defined spectra of a beam of light passing through a fine vertical slit in a steel plate by prisms of flint and crown glass and of quartz. The spectrum, being concentrated by a lens, was received upon a white tablet and submitted to careful admeasurement; the coloured screen (sometimes coloured glass and sometimes coloured fluid) was then interposed, and the alterations in the chromatic image were carefully noted; the chemical preparation was then placed upon the tablet, and the chemical impression obtained. The relation which this image bore to the luminous image was a true representation of the connexion between the colour of a ray, and its power to produce chemical change. In the report made to the Belfast meeting of the British Association, the results of experiments made upon glass plates prepared by the so-called collodion process were alone given. In the present report the examination has been extended to the photographic preparation known as the calotype, and to iodide and bromide of silver in their pure state and when excited by gallic acid. M. Edmond Becquerel, in a paper communicated to the Academy of Sciences, of which an abstract appears in the *Comptes Rendus*, tom xvii. p. 883, states "that when any part of the luminous spectrum is absorbed or destroyed by any substance whatever, the part of the chemical rays of the same refrangibility is also destroyed." The author's experiments, as recorded in the former report and those now detailed, prove that his conclusion has been formed too hastily. Although there are many absorptive media which, at the same time as they obliterate a particular coloured ray, destroy the chemical action of that portion of the spectrum, yet there are still more extensive series which prevent the passage of a ray of given refrangibility, and do not, at the same time, obstruct these rays which are chemically active of the same degree of refrangibility. This is particularly exemplified in the case of glass turned yellow by different preparations. With some of these the blue rays are obliterated, the chemical action of this part of the spectrum not being interrupted, whereas in some other examples, those rays permeate the glass, but are almost entirely deprived of chemical power. A still more curious fact is noticed in this report, for the first time, of some media which have the power, as it were, of developing chemical action in a particular part of the spectrum where the rays did not appear previously to possess this power. Several glasses exhibited this phenomenon to a certain extent, particularly such as were stained yellow by the oxide of silver; but one glass showed this in a remarkable manner. This glass was yellow when viewed by transmitted light, but it reflected pale blue light from one of its surfaces; it obliterated the more refrangible rays down to the green, and rendered the yellow rays far less luminous than usual. In nearly every case the yellow rays are found to be not merely inactive, chemically, but to actively prevent chemical action. After the spectrum has been submitted to the action of this glass, *all chemical power is confined to this yellow ray*. The author has hitherto supported the view that photographic phenomena and the illuminating power of the sunbeam were distinct principles, united only in their modes of motion. He was led to this from observing that where there was the most light there was the least power of producing chemical change; and that as illuminating power diminished, the chemical phenomena

of the solar rays increased. The results, however, which he has obtained during the brief sunshine of the present summer, leads him to hold that opinion in suspension. In many of the spectra obtained (copies of which will be appended to the printed report) there appears to be evidence of the conversion of one form of force into another—the change indeed of *light* into *action* or chemical power; and, again, as in Mr. Stokes' experiments the exhibition of the ordinarily invisible chemical rays in the form of *light*.

Prof. Stokes offered some remarks upon the different effects produced by the spectrum, dividing them into luminous effect, chemical action, calorific power, phosphorescence, and fluorescence. These were different effects resulting from the same cause, and he did not consider that sufficient evidence had yet been given to warrant the idea that there existed any dissimilar agencies in the solar rays.

Prof. Johnston, the Rev V. Harcourt, Dr. Daubeny, Mr. Claudet, and others, took part in the conversation which followed.

'*On the Employment of the higher sulphides of Calcium as a means of Preventing and Destroying the Oidium Tuckeri, or Grape Disease*,' by DR. ASTLEY P. PRICE.—Of the many substances which have been employed to arrest the devastating effects of this disease, none appear to have been so preeminently successful as sulphur, whether employed in the state of powder or flowers of sulphur, or by sublimation in houses so affected. Notwithstanding the several methods described for its application to the vines, I am not aware that any had been offered in 1851, when these experiments were instituted, by which sulphur might be uniformly distributed over the branches, and be there deposited in such a manner as to be to some extent firmly attached to the vine. Three houses at Margate, in the vicinity of the one in which the disease first made its appearance in England, having been for the space of five years infected with the disease, and notwithstanding the employment of sulphur as powdered and flowers of sulphur, no abatement in its ravages could be discovered,—I was induced to employ a solution of pentasulphide of calcium, a solution of which having been found to act in no way injuriously to the young and delicate shoots of plants, was applied to the juices in a dilute condition: the object in view being that the compound should be decomposed by carbonic acid, and that the excess of sulphur should be deposited with the carbonate of lime in a uniform and durable covering on the stems and branches of vines. This was adopted, and although but few applications were made, the stems became coated with a deposit of sulphur, and the disease gradually but effectually diminished, in so much that the houses are now entirely free from any trace of disease or symptoms of infection. The young shoots are in no way injured by its application, and the older wood covered with this deposit of sulphur continues exceedingly healthy. This was, we believe, the first employment of the higher sulphides of calcium as a vehicle for the application of sulphur to the stems and foliage of the diseased vines. Specimens were exhibited from vines which in 1851 were covered with disease, and which have since the autumn of that year received no further treatment. The vines in the immediate neighbourhood, and adjoining one of the houses, are covered with disease, but, notwithstanding their close proximity, no indication of the disease has at present been detected in either of the three houses.

'*On the effect of Sulphate of Lime upon Vegetable Substances*,' by CHEVALIER CLAUSSEN.—About six weeks since I was engaged in making various experiments on the effect of Sulphate of lime upon vegetable substances. A portion of the substances then used by me was thrown carelessly aside, and upon returning to my experiments about a fortnight afterwards, I was surprised that the decomposition had not taken place in those portions of the vegetables which had been subjected to the action of the sulphate, while those which had not been so treated were completely decayed. Among the articles experimented upon were a number of potatoes, each of which was affected by the prevalent disease; some of these remain sound to the present day, the others have some time since completely rotted away. Subsequently I procured some more potatoes, and also some beet-roots, the former being, as far as I could judge, all diseased. I divided the potatoes into three portions. One lot I placed in a vessel with a weak solution of sulphuric acid, and from thence I placed them in a solution of weak lime-water. In the second lot the process was reversed, that is to say the potatoes were first placed in the lime-water, and then in the acid. The third lot was left untouched. Ten days afterwards I examined the potatoes, those which had not been treated with the sulphate were rapidly decaying,—those which had been first placed in the solution of lime and then in the acid were more nearly decomposed,—while those which had been treated in the mode first described remained as sound as when first taken in hand. Upon being cut open the diseased part of the potatoes was found to have spread internally, and the flavour of root was in no degree affected by the application of the process nor do I think that its germinating power was injured by the effect of the sulphate. The effects upon the beet roots was similar to that produced upon the potato, and which would seem to be somewhat analagous to that of galanizing metals, viz: protecting the substances from the effect of atmospheric agencies. I may add, that muriatic and other acids have been employed by me on other occasions with equal success, the only agents required appearing to be those which will most readily produce a sulphate in contact with the substances required to be preserved. As at present it does not appear that any means can be successfully adopted to prevent the potato from becoming diseased while in the ground and arriving at maturity, it would certainly be of immense advantage if anything could be discovered by the use of which the roots when taken up could be prevented from that absolute decay and irreparable loss to which potatoes affected by the disease are liable. The results which I have described seem to me to point to the possibility of arresting this loss. How far the plan suggested may be practicable or applicable upon a large scale, my present very pressing and numerous engagements have hitherto prevented me from ascertaining. I do not think that any insuperable difficulty exists with respect to the application of the process. The acid employed by me was very weak, about one part to two hundred of water; the lime water was about the consistency of milk. The materials are not, therefore, expensive: and when the value of the crop to be saved is taken into consideration, it would be a matter well worthy of being tested by some of those extensive growers of potatoes in the county in which the British Association is now holding its sittings. For my own part, I should be most happy if any suggestion of mine had merely been the instrument of directing the attention of scientific men to the subject of the possibility of preserving from total destruction a vegetable so valuable and so indispensable as the potato.

'*The results of the Census of Great Britain in* 1851, *with a description of the machinery and processes employed to obtain the Returns*,' by E. CHESHIRE.—The author commenced by reciting the onerous duties of Registrar General. The objects of the census were explained, and the machinery employed to take it. Great Britain was apportioned into 38,740 enumeration districts, and to each of them a duly qualified enumerator was appointed. The author illustrated the extent of this army of enumerators, and the labour of engaging their services on the same day, by stating that it would take 13½ hours to count them, at the rate of one a second, and that the army recently encamped at Chobham would not have sufficed to enumerate a *fourth* of the population of Great Britain. The boundaries of the enumeration districts, and the duties of the enumerators, were defined. The number of householders schedules forwarded from the Census Office was 7 [illegible] 000, weighing 40 tons. The processes employed to enumerate persons sleeping in barns, tents and the open air, and in vessels, were severally explained; also the means by which the numbers of British subjects in foreign States were obtained. The precautions taken to ensure accurate returns were recited; they involved the final process of a minute examination and totalling, at the Census Office, of 20 millions of entries, contained on upwards of 1¼ millions of pages of the enumerators' books. The latter were upwards of 38,000 in number. The boundaries of the fourteen registration divisions were traced, and the plan of publication of the census was explained. The number of persons absent from Great Britain on the night of the 30th of March, was nearly 200,000:—viz army, navy, and merchant service, 16[illegible]; and British subjects resident and travelling in foreign countries, 33,775. The various causes of displacements of the population were recited, and the general movement of the population on the occasion of the Great Exhibition was alluded to.† The number of *visits* to the Crystal Palace were 6,039,19[illegible]; and the number of people who visited it was 2,000,000, nevertheless the landing of only 65,233 aliens were reported in the year. The population of Great Britain in 1851 is subjoined.

	Males.	Females.	Total
England	8,281,734	8,640,154	16,921,888
Scotland..............	1,375,479	1,513,263	2,888,742
Wales	499,491	506,230	1,005,721
Islands..............	66,854	76,272	143,126
Army, Navy and Merchant Service.	162,490	......	162,490
Total..............	10,386,048	10,735,919	21,121,967

The census illustrated this 21,000,000 of people by an allusion to the Great Exhibition. On one or two occasions 100,000 visited the Crystal Palace in a single day, consequently 211 days of such a living stream would represent the number of the British population. Another way of realizing 21,000,000 of people was arrived at by considering their numbers in relation to space; allowing a square ya

to each person they would cover 7 square miles. The author supplied a further illustration, by stating that if all the people of Great Britain had to pass through London in procession 4 abreast, and every facility was afforded for their free and uninterrupted passage 12 hours daily, Sundays excepted, it would take nearly 3 months for the whole population of Great Britain to file through at quick march, four deep. The excess of females in Great Britain was 512,361, or as many as would have filled the Crystal Palace 5 times over. The proportion between the sexes was 100 males to 105 females, a remarkable fact when it was considered that the births during the last 13 years had given the reversed proportion of 105 boys to 100 girls. The annexed statement exhibits the population of Great Britain at each census from 1801 to 1851 inclusive:—

Years.	Males.	Females.	Total.
1801	5 368 703	5.518,730	10 917.433
1811	6.111.261	6,312 859	12 424.120
1821	7 096 053	7.306,590	14.402,643
1831	8 133 416	8 430,692	16,564 138
1841	9 232.418	9.581 368	18.813,786
1851	10 386,048	10.735 919	21,121,967

The increase of population in the last half century was upwards of 10 000,000, and nearly equalled the increase in all preceding ages, notwithstanding that millions had emigrated in the interval. The increase still continued, but the rate of increase had declined, chiefly from accelerated emigration. At the rate of increase prevailing from 1801 to 1851, the population would double itself in 52½ years. The relation of population to mean lifetime and to interval between generations was then discussed. The effects of fertile marriages and of early marriages, respectively, were stated; also the result of a change in the social condition of unmarried women; likewise, the effect of migration and emigration, respectively, on population; the effect of an abundance of the necessaries of life was indicated, and, on the contrary, the result of famines, pestilences, and calamities. The terms "family" and "occupier" were defined, and some remarks by Dr. Carus, on English dwellings, were cited. The English (says the Doctor) divide their edifices *perpendicularly* in houses, while on the Continent and in many parts of Scotland the edifices are divided *horizontally* into floors. The definition of a "house," adopted for the purposes of the census, was "isolated dwelling or dwellings, separated by party walls." The following table gives the number of houses in Great Britain in 1851:

	Inhabited.	Uninhabited.	Building.
England	3 076 620	144,499	25.192
Scotland	37 .308	12.146	2.420
Wales	201.4 9	8 995	1,379
Islands	21 845	1.095	203
Total	3 670 92	166 735	29 194

About 4 per cent of the houses in Great Britain were unoccupied, in 1851, and to every 131 houses inhabited or uninhabited, there was one in course of erection. In England and Wales the number of persons to a house was 5·5; in Scotland 7·8, or about the same as in London; in Edinburgh and Glasgow the numbers were respectively 20·6 and 27 5. Subjoined is a statement of the number of inhabited houses and families in Great Britain at each census, from 1801 to 1851,—also of persons to a house, excluding the Islands in the British Seas:—

Years.	Inhabited Houses.	Families.	Persons to a House.
1801	1 870 476	2,260,802	5 6
1811	2 101.597	2 544 215	5·7
1821	[illegible]	2,941.383	5·8
1831	2 85[illegible].937	3 414.175	5 7
1841	3 446 797	(No returns.)	5·4
1851	3,618,347	4 312,388	5·7

The number of inhabited houses had nearly doubled in the last half century, and upwards of two million new families had been founded. 67,609 families, taken at hazard, were analyzed into their constituent part, and they gave some curious results. About 5 per cent. only of the families in Great Britain consisted of husbands, wife, children, and servants, generally considered the requisites of domestic felicity; while 893 families had each ten children at home, 317 had each eleven and 64 had each twelve. The number of each class of institution, and the number of persons inhabiting them, are annexed:—

Class of Institution.	Number of Institutions.	Number of Persons inhabiting them.		
		Males.	Females.	Total.
Barracks	174	44,834	9.100	53,933
Workhouses	746	65,786	65.796	131.582
Prisons	257	24 593	6 369	30 959
Lunatic Asylums	149	9,753	11,251	21 004
Hospitals	118	5 893	5.754	11.647
Asylums, &c.	573	27. 83	19 548	46.731
Total	2017	178 041	1 7,815	295 856

Of these 295,856 persons, 260 340 were inmates, and 35.516 officers and servants. The excess of males in the prisons arose from the fact that crime was four times as prevalent among males as among females. The number of the houseless classes, *i. e.*, of persons sleeping in barns, tents, and the open air, on the night of the census, was 18,249. The following table gives the number of these classes, together with those sleeping in barges and vessels:—

Persons sleeping in	Males.	Females.	Total
Barges	10 395	2 529	12 924
Barns	7,251	2 721	9.972
Tents or Open Air	4 614	3 663	8,277
Vessels	48,895	2 853	51,748
Total	71,155	11 766	82 921

It was mentioned as a curious trait of gypsy feeling that a whole tribe struck their tents, and passed into another parish in order to escape enumeration. The composition of a town was next described; also, the laws of operating upon the location of families. The number of cities and towns of various magnitudes in Great Britain, was 815:—viz. 580 in England and Wales, 225 in Scotland, and 10 in the Channel Islands. The town and country population was equally balanced:—10½ millions against 10½ millions. The density in the towns was 3 337 persons to the square mile; in the country only 120. The average population of each town in England and Wales was 15 500; of each town in Scotland 6,654. The average ground area of the English town was 4 3-5 miles. The manner in which the ground area in Great Britain was occupied by the population was illustrated by a series of squares. The adventitious character of certain towns was alluded to; many had risen rapidly from villages to cities, and had almost acquired a metropolitan character. In 1851, Great Britain contained 70 towns, of 20 000 inhabitants and upwards. There was an increasing tendency of the people to concentrate themselves in masses. London extended over an area of 78 029 acres or 112 square miles, and the number of its inhabitants, rapidly increasing, was 2,362.236 on the day of the last census. The author illustrated this number by a curious calculation:—a conception of this vast mass of people might be formed by the fact, that if the metropolis was surrounded by a wall, having a north gate, a south gate, an east gate, and a west gate, and each of the four gates was of sufficient width to allow a column of persons to pass out freely four abreast, and a peremptory necessity required the immediate evacuation of the city, it could not be accomplished under four-and-twenty hours, by the expiration of which time the head of each of the four columns would have advanced a no less distance than seventy-five miles from their respective gates, all the people in close file, four deep. In respect to the density or proximity of the population, a French writer had suggested the term "specific population," after the analogy of "specific gravity" in lieu of the terms in common use, "thinly populated" and populous. The statement annexed exhibits the area of Great Britain in acres and square miles, the square in miles, the number of acres to a person, or persons to a square mile, and the mean proximity of the population on the hypothesis of an equal distribution:—

	Area.		Square (in Miles.	Acres to a Person.	Persons to a sq. mile.	Proximity of persons in yards.
	In acres.	In sq. Miles.				
England	32 590 129	50 922	226	1 9	332	104
Scotland	20 047,462	31 321	177	6·9	92	197
Wales	4 734 486	7,398	86	4·7	135	162
Islands	252,000	394	20	1 8	363	99
Great Britain	57 624 377	90 038	229	2·7	233	194

The 624 districts of England and Wales classed in an order of density ranged from 18 persons to the square mile in Northumberland, to 185,751 in the east London district. In all Lnodon there were 19,375

persons to the square mile. In 1801, the people of England were on an average 153 yards asunder, in 1851 only 107 yards. The mean distance between their houses in 1801 was 362 yards, in 1851 only 252 yards. In London the mean proximity in 1801 was 21 yards, in 1851 only 14 yards. The number of islands in the British group were stated at 500, but inhabitants were only found on 175 on the day of the census. The early history of the more celebrated of the islands was given. The population of the chief of the group, Great Britain, had been given. Ireland contained 6,553 357 inhabitants; Anglesey, the next most populous island, had 57,318 inhabitants; Jersey, 57,020; the Isle of Man, 52,344; the Isle of Wight, 50. 24; Guernsey, 29 757; eight islands ranged from 22,918 to 5,857, 17 from 4 006 to 1,061, 52 from 947 to 105, and the remaining 92 downwards to an island inhabited by one solitary man. The shires, hundreds, and tythings, were traced to Alfred the Great; the circuits to Henry the Second. The terms "hundreds" and "tythings" had their origin in a system of numeration. The number of reformed boroughs in England and Wales were 196, and contained a population of 4,345,269 inhabitants. Scotland contained 83 royal and municipal burghs, having a population of 752,777 inhabitants. The difficulty of tracing the boundaries of the *ecclesiastical* districts, and consequently of ascertaining correctly their population, was shown. The changes in the ancient boundaries of counties and other divisions were alluded to, and the paper concluded with a general summary of the results of the census. An appendix contained tables, showing the population and number of houses, distinguishing whether inhabited, uninhabited, or building, in England, Scotland, Wales, and the Islands, respectively, at each census from 1801 to 1851; the same in 1851, for each of the 14 registration divisions; for each of the 36 districts of London; and for each county in England and Wales, and in Scotland; also the population of each county in England and Wales, and in Scotland, at each census from 1801 to 1851, and the increase of population in the last half century; the area in acres and square miles, the number of persons to a square mile, of acres to a person, of inhabited houses to a square mile, and of persons to a house, for each county in England and Wales, and in Scotland; the population and number of inhabited houses in the counties, and parliamentary divisions of counties, in England and Wales, and in the counties of Scotland, including and excluding represented cities and boroughs or burghs, also the number of members returned: the population of each island containing above 100 persons; the population and number of inhabited houses in each of the 815 cities, boroughs, and principal towns in England and Wales and in Scotland, distinguishing the municipal and parliamentary limits; the number of each class of public institutions in England and Wales, Scotland, and the Islands, and the number of persons inhabiting them; the number of births and deaths, and the excess of births over deaths, in England and Wales, for each of the ten years of 1841–50; and finally, the number of persons who had emigrated from Great Britain and Ireland in each year from 1843 to 1852 inclusive and the destination of the emigrants. The author concluded by stating that the paper would be immediately printed.

Section G.—MECHANICAL SCIENCE

'*Introductory Address on General Improvements in Mechanical Science During the Past Year,*' *by* W. Fairbairn.—The first subject noticed by Mr. Fairbairn was Ericsson's Caloric Engine, from which so much had been expected. It was constructed, he said, on the same principle as the air engine of Dr. Stirling, invented ten years ago:—the engine is passed through wire gauze to take up the heat, instead of through plates of iron. The great objection to the engine appeared to be that two-thirds of the power was wasted in passing the air through the gauze; and though it may be premature to pronounce an opinion before the result of the improvements lately effected were known, yet if so much of the power was required for taking up the heat, Mr. Fairbairn could not but think it must prove a wasteful expenditure of fuel. The improvements that during the last year had been made in the application of the screw propeller were opening a new era in the history of our war and mercantile navy, of which the recent review at Spithead might be considered an indication. We were now in a state of transition between the paddle and the screw, and he had no doubt that in progress of time great improvements would be made in the construction of the engines, and their applicability to the work, which would materially economize space and power in our steam vessels. Mr. Fairbairn next alluded to the construction of an immense steam vessel, which had been undertaken by Mr. Brunel and Mr. Scott Russell, of such vast dimensions that it would stretch over two of the largest waves of the Atlantic, and would thus obtain a steadiness of motion, which would be a preventive against sea sickness. This mammoth steamer is to be 680 feet long, with a breadth of beam of 83 feet and a depth of 58 feet. The combined power of the engines would be that of 2,600 horses. The ship is to be built of iron with a double bottom of cellular construction, reaching six feet above the water line, and with a double deck, the upper and the lower parts being connected together on the principle of the Britannia tubular bridge, so that the ship will be a complete beam. It would thus possess the strength of that form of construction, and not be liable to "hogg," or break its back as had been the case with other ships of great length. The double bottom would be a means of increased safety in other ways, for if by any accident the outer shell were broken, the inner one would prove effectual to keep out the water.—As an additional security, however, it was divided into ten water-tight compartments. The ship would be propelled by paddles and by a screw, which would be worked by separate sets of engines, so that if any accident occurred to the machinery of one, the other would be in reserve. He said he had no doubt that if properly constructed, this ship would answer the expectations entertained of its capabilities and strength, and that it would form, when completed, the most extensive work of naval architecture that had ever been constructed. The next subject to which Mr. Fairbairn adverted, was the improvements making in the locomotive department of railways, particularly to an engine constructed for the southern division of the North-Western Railway, from the designs of Mr. McConnell, which was the most powerful locomotive that had yet been made for the narrow gauge. The peculiarity of construction consisted in the great length given to the fire-box, in which the greatest amount of steam always generated, and in the comparative shortness of the tubes, which were only half the usual length. The steam generated by this boiler was sufficient for any engine of 700 horse power. The engine was intended for an express train that would complete the distance from London to Birmingham in two hours. In manufacturing machinery there had also been great activity and progress during the past year; and it was gratifying, Mr. Fairbairn observed, to find accompanying this improvement in machinery a most prosperous condition in the working classes engaged in those manufactures—a prosperity which had never been equalled within his experience. He attributed this prosperous state of things to the combined operations of improvements in machinery and the removal of commercial restrictions. The improvement which he more especially noticed was that of a new combing machine of French invention applicable alike to cotton, to flax, and to wool. It combs the fibre instead of carding it, a number of small combs being applied in succession to the cotton or flax, by which means a much finer yarn can be produced from the same material than is possible by the former processes. As evidence of the present activity and enterprise in manufacturing industry, Mr. Fairbairn mentioned the erection of a mammoth alpaca woollen manufactory, by Mr. Salt, of Saltaire, near Bradford, which was 550 feet long, 50 feet wide, and six stories high, besides offices, warehouses, and various other buildings connected with it. Their steam engines to drive the machinery would be equal to 1,200 horse power, and the factory would employ upwards of 3,000 hands The cost of the whole would be upwards of £300 000, and the enterprise was that of a single individual. Mr Fairbairn concluded his *resume* of manufacturing progress by noticing the improvements introduced by Prof. Crace Calvert, of Manchester, in process of melting iron by previously removing the sulphureous vapour from coal and smoke. The results had proved most satisfactory, the strength of the iron produced by this process being about 40 per cent. greater than that made in the ordinary way.

'*Report of the Committee appointed in* 1852 *to prepare a Memorial to the Honourable East India Company, on the Means of Cooling Air in Tropical Climates,*' *by* W. J. Macquorn Rankine.—In the absence of Mr. Rankine, one of the Secretaries read the Report, which was founded on experiments with apparatus invented by Prof. Smyth, described by him at a previous meeting of the Association. The principle of the invention consists in cooling the air by expansion. The air at the temperature of the atmosphere is first compressed in a bell receiver, and the heat generated by this compression is lowered by passing the air through a number of tubes immersed in water, by which means it acquires in its compressed state the normal temperature of the atmosphere—say 90° of Fahrenheit. The air then passes into another inverted bell receiver, where it is expanded to the ordinary pressure of the atmosphere, and during this expansion, it absorbs so much heat that the temperature is reduced to 60°. It is then admitted into the room to be ventilated. The compression of the air during the experiments in the first cylinder was equal to 3 2-10 inches of mercury per square inch above the pressure of the atmosphere, and the refrigerator exposed a cooling surface of 1,100 square feet, which was considered sufficient to reduce the temperature of the air in passing through the tubes to that of the atmosphere, viz. 90°. The Report stated that by means of this apparatus, 66,000 cubic feet of air per hour might be cooled from 90° to 60°, by a steam-engine of one-horse power which is required to raise and depress the bell receiver. The advantage of cooling the air by mechanical means instead of by evaporation was stated to be, the avoidance of aqueous vapour with which the air is injuriously charged by the evaporating process.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—September, 1853.

Latitude 43 deg. 39.4 min. North. Longitude, 79 deg. 21 min. West. Elevation above Lake Ontario : 108 feet.

Magnet.	Day.	Barom. at tem. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of the air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	M'N V	Rain in Inch.	S'nw in Inch.
						°	°	°	°												Miles		
a	1	29.771	29.780	29.790	29.783	60.7	73.3	60.1	65.97	0.460	0.498	0.412	0.461	89	63	80	75	N b E	E S E	N E b E	4.27	- -	- -
e f	2	.814	.742	.707	.752	60.8	77.8	67.6	69.87	.366	.664	.453	.628	69	72	69	73	N b E	S E b E	Calm	2.31	- -	- -
c	3	.722	.697	.689	.711	65.0	80.8	65.9	70.97	.515	.726	.548	.620	91	71	88	84	Calm	S b E	Calm	1.96	- -	-
c	4	.672	.609			61.1	80.1			.457	.570			92	57			Calm	S E b S		2.18	- -	-
b	5	.633	.577	.514	.579	66.1	85.4	73.9	75.22	.576	.690	.571	.623	93	58	70	74	E b N	S	Calm	4.51	Inap	- -
d	6	.574	.462	.466	.502	69.8	78.4	62.8	70.35	.619	.815	.464	.633	88	86	83	86	Calm	S E b E	N	4.57	1.990	- -
c	7	.510	.600	.714	.617	60.5	66.2	51.7	59.40	.456	.311	.290	.352	88	55	77	72	N N W	N N W	N N W	6.70	- -	- -
b	8	.791	.811	.841	.816	53.1	69.0	55.0	60.65	.322	.423	.325	.354	82	62	69	70	N N W	S b E	N b E	4.18	- -	- -
c	9	.832	.730	.648	.737	53.5	70.7	63.8	63.37	.345	.445	.447	.420	86	61	78	76	N E b N	E S E	S S W	5.55	Inap	-
c	10	.758	.755	.857	.796	46.3	66.2	49.1	51.88	.256	.317	.269	.277	83	51	78	68	Calm	W b N	Calm	4.26	- -	-
c	11	.870	.873			49.3	62.9			.242	.298			70	54			N N W	S b W		1.65	- -	-
b	12	.901	.843	.762	.830	39.9	64.9	55.5	55.93	.179	.318	.298	.305	73	58	69	68	Calm	S E b S	Calm	1.43	- -	- -
a	13	.717	.625	.569	.621	50.0	66.2	61.9	60.83	.298	.437	.415	.406	84	70	77	78	Calm	S b W	Calm	2.33	0.250	- -
b	14	.494	.283	.082	.278	57.1	61.1	55.7	59.80	.432	.493	.480	.462	92	94	99	92	N E	E N E	N N E	9.80	1.895	- -
d	15	.274	.383	.542	.411	58.1	67.1	56.9	61.28	.435	.401	.327	.390	92	62	72	76	N W b W	N W	Calm	6.61	- -	- -
b	16	.632	.610	.516	.579	50.4	66.4	64.3	61.22	.303	.514	.534	.460	84	82	91	86	Calm	E	E S E	2.41	0.040	- -
a	17	.498	.451	.457	.476	58.8	77.3	70.6	67.52	.430	.751	.655	.595	83	82	90	87	Calm	S E	Calm	1.66	Inap	- -
e	18	.503	.482			67.2	75.7			.587	.679			91	79			E b N	S E		3.70	Inap	- -
c	19	.368	.472	.558	.473	69.8	64.0	60.3	64.52	.611	.517	.484	.543	87	94	95	91	S	S W b W	Calm	4.52	0.350	- -
e	20	.620	.556	.552	.573	59.3	65.2	51.0	56.08	.317	.473	.314	.382	89	78	91	87	S S W	S E	W	3.00	0.115	- -
b	21	.558	.587	.630	.593	49.2	58.1	52.8	53.95	.302	.390	.323	.340	88	83	82	83	W b N	N W	N W	7.67	- -	- -
d	22	.654	.630	.642	.639	49.5	56.0	47.2	50.47	.292	.272	.268	.277	83	62	84	77	N N W	N N E	S b W	2.66	- -	- -
b	23	.625	.580	.551	.585	47.2	66.6	57.8	57.43	.278	.463	.420	.391	87	73	90	84	Calm	S b E	S W b S	2.39	- -	- -
b	24	.422	.575	.801	.614	60.5	62.1	46.4	55.62	.446	.276	.214	.310	87	51	68	69	S W b S	N W	N W b N	8.42	- -	- -
b	25	.903	.905			37.8	54.2			.172	.289			76	70			Calm	S b W		3.02	- -	- -
b	26	.933	.787	.723	.801	47.1	59.4	51.0	53.32	.252	.340	.321	.313	79	69	87	78	N E b N	E	E N E	5.94	Inap	- -
b	27	.720	.590	.493	.590	48.1	48.3	42.7	46.52	.291	.307	.271	.291	88	92	1.00	94	E N E	E b N	N N E	7.77	0.500	- -
e	28	.554	.665	.861	.705	42.3	53.5	41.6	45.92	.252	.197	.193	.203	94	49	75	69	N	N b W	N N W	8.42	- -	- -
b	29	.976	.943	.900	.939	37.4	51.1	36.1	42.30	.165	.227	.184	.185	74	62	87	71	N W b N	S S E	E b N	2.91	- -	- -
b	30	.830	.707	.599	.694	37.0	52.6	42.7	45.77	.207	.270	.214	.230	95	69	79	78	N N E	E	N N E	2.10	- -	- -
	M	29.661	29.632	29.641	29.642	53.40	65.68	55.80	58.81	0.363	0.447	0.382	0.393	86	70	82	79	Ml's 3.30	Ml's 6.43	Ml's 3.26	4.30	5.140	

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North, 1513.11 ; West, 804.37 ; South, 758.52 ; East, 872.38.

Mean direction of the wind, North.

Mean velocity of the wind - - 4.30 miles per hour.

Maximum velocity- - - - - 20.7 miles per hour, from 10 to 11 p.m. on 14th

Most windy day - - - - - - 14th: Mean velocity, 9.80 miles per hour.

Least windy day - - - - - - 12th Mean velocity, 1.43 ditto.

Raining 47.9 hours on 12 days.

14th.—The velocity of the Wind from 10h. 0m., to 10h. 10m. p.m., was at the rate of 40.2 miles per hour, and from 10h. 10m., to 10h. 20m. p.m., at the rate of 46.8 miles per hour, being the greatest velocity ever recorded at this Observatory.

Highest Barometer - - 29.999, at 8 A.M., on 29th. } Monthly range:
Lowest Barometer - -28.946, at 10.20 P.M., on 14th. } 1.053 inches.

Highest regist'd Temp. - 85.5, at — P.M., on 5th } Monthly range.
Lowest regist'd Temp. - 33.9, at — A.M., on 30th } 51.6

Mean Maximum Temperature - - - - 67.87 } Mean daily range:
Mean Minimum Thermometer - - - - - 49.45 } 18.42

Greatest daily range - - - - - 32.2 from P. M. 24th to A. M. of 25th.

Warmest day - - 5th - - - Mean Temperature - 75.22 } Difference
Coldest day - - - 29th - - - Mean Temperature - 42.30 } 32.92

The "Means" are derived from six observations daily, viz., at 6 and 8 A. M., and 2, 4, 10 and 12, P. M.

Aurora observed on 7 nights. Possible to see Aurora on 19 nights. Impossible to see Aurora on 11 nights.

The column headed "Magnet" is an attempt to distinguish the character of each day, as regards the frequency or extent of the fluctuations of the Magnetic declination, indicated by the self-registering instruments at Toronto. The classification is, to some extent, arbitrary, and may require future modification, but has been found tolerably definite as far as applied. It is as follows:

(*a*) A marked absence of Magnetical disturbance.
(*b*) Unimportant movements, not to be called disturbance.
(*c*) Marked disturbance—whether shewn by frequency or amount of deviation from the normal curve—but of no great importance.
(*d*) A greater degree of disturbance—but not of long continuance.
(*e*) Considerable disturbance—lasting more or less the whole day.
(*f*) A Magnetical disturbance of the first class.

The day is reckoned from noon to noon. If two letters are placed, the first applies to the earlier, the latter to the later part of the trace. Although the Declination is particularly referred to, it rarely happens that the same terms are not applicable to the changes of the Horizontal Force also.

Comparative Table for September.

Year.	Temperature. Mean.	Max. obs'rvd	Min. obs'rvd	Range.	Rain. D'ys	Inches.	Snow. Dy's	Inch.	Wind Mean Velocity
	°	°	°	°					Miles.
1840	51.0	70.2	29.4	40.8	4	1.330	0	--	-
1841	61.3	79.9	37.5	42.4	9	3.340	0	--	--
1842	55.7	83.5	28.3	55.2	12	6.160	0	--	--
1843	59.1	87.8	33.1	54.7	10	9.760	0	--	0.57lb
1844	58.6	81.5	29.6	51.9	4	imperfect	0	--	0.26lb
1845	56.0	78.8	35.3	43.5	16	6.215	0	--	0.34lb
1846	63.6	84.0	39.0	45.0	11	4.565	0	--	0.33lb
1847	55.6	71.8	38.1	36.7	15	6.635	0	--	0.33 b
1848	54.2	80.9	29.5	51.4	11	3.115	0	--	5.81m
1849	58.2	80.6	33.5	47.1	9	1.480	0	--	4.23m
1850	56.5	76.0	31.7	41.3	11	1.735	0	--	4.75m
1851	60.0	86.3	33.4	52.9	9	2.665	0	--	51.5m
1852	57.5	81.8	36.1	45.7	10	3.630	0	--	4.60m
1853	58.8	85.4	36.1	49.3	12	5.140	0	--	4.30m.
Mean	57.79	80.82	33.61	47.21	10.2	4.301	0		0.37 lbs 4.96 Ml

METEOROLOGICAL OBSERVATIONS.

During the Storm of 14th August, 1853.

Magnetic Observatory, Toronto.

The Barometer has been falling gradually from 29.922 inches on the 12th, at 8 a.m., to 29.082 at 10 p.m., on the 14th. The wind on the 12th and 13th had been mostly calm, or W. and S.W., the motion of the clouds being from W. and S.W., and increasing in extent till 8 a.m. on the 13th, when the sky was overcast, and continued so, the humidity, also, increasing till it reached .99 at 10 p.m. on the 14th. The wind changed on the morning of the 14th, about midnight, to N.N.E., and rain fell during the night.

The 14th was densely clouded, and there was steady rain all day, the wind creeping round to the N., and the velocity increasing from 1.6 miles at 6 a.m. to 22.0 at 10 p.m. At this time the violence of the storm increased the wind N.N.E., Barometer, 29.082, Thermometer, 58.7°, Humidity 99 at 10.12 p.m. Barometer 28.992; from 10 h. to 10 h. 10 m., the wind had traversed 6.7 miles, or at the rate of 40.2 miles per hour; in the previous half hour its rate was 13.4 miles per hour.

At 10h. 20m. Barometer 28.946, from 10h. 10m. to 10h. 20m., the wind had traversed 7.8 miles, being at the rate of 46.8 miles per hour. A sudden lull now took place the Barometer beginning to rise.

At 10h. 30m. Barometer 29.028, rate of wind for this 10m., being 63. miles per hour. The wind now gradually veered round by S., and at 11 p.m. it had got round to N.W. by N. having changed through ¾ of the circle.

At 11h Barometer 29.112 velocity of wind from 10h. 30m. to 11 p.m. was 10.6 miles per hour, at 10h. 11m. rain ceased, and the storm was over, the Barometer continued to rise steadily.

The quantity of rain which fell during the day was 1.895 inches on the surface.

Monthly Meteorological Register, St. Martin, at Isle Jesus, Canada East, September, 1853.

Nine Miles West of Montreal.

[BY CHARLES SMALLWOOD, M. D.]

Latitude—45 *deg.* 32 *min. North. Longitude*—73 *deg.* 36 *min. West. Height above the Level of the Sea*—118 *ft.**

Day.	Barom: corrected and reduced to 32° Fahr. 6 A. M.	2 P. M.	10 P. M.	Temp. of the Air. 6 A. M.	2 P. M.	10 P. M.	Tension of Vapour. 6 A. M.	2 P. M.	10 P. M.	Humi'y of the Air. 6 A. M.	2 P. M.	10 P. M.	Direction of Wind. 6 A. M.	2 P. M.	10 P. M.	Velocity in Miles per Hour. 6 A. M.	2 P. M.	10 P. M.	Rain in Inch.	Weather, &c. A cloudy sky is represented by 10; a cloudless sky by 0. 6 A. M.	2 P. M.	10 P. M.
1	29.592	29.600	29.618	52.1	80.3	65.2	.373	.532	.527	.93	.53	.85	N W b W	W b N	S W	0.12	Calm.	0.10		Clear.	Clear.	Clear, A. Borealis
2	.652	.538	.520	60.0	86.2	70.2	.501	.648	.515	.98	.53	.70	S W	W	S S W	Calm.	0.27	1.54		Clear.	Clear.	Clear, A. Borealis
3	.510	.433	.455	66.2	83.1	71.0	.605	.715	.684	.94	.64	.86	S S W	W S W	W S W	0.37	3.13	3.09	Inap.	Clear.	Slight Showers.	Clear, A. Borealis
4	.421	.308	.252	70.1	84.0	74.6	.628	.638	.648	.86	.56	.78	W b S	W b S	W	3 65	10.79	2.87		Clear.	Cirr. Cum. 4.	C. S. 9. Rain 10.28
5	.320	.383	.286	53.1	58.0	53.1	.361	.412	.386	.87	.84	.93	N E	N E	N E	9.42	3.75	2.26	0.236	Cir. Str. 9.	Cir. Str. 10.	Clear, S't L'ning.
6	.285	.212	.263	57.6	83.6	68.0	.422	.787	.652	.89	.71	.96	N E b E	W b S	N E	Calm.	Calm.	2.25		Cear.	Str. 4.	Th'er St'm8.15pm
7	.158	.189	.303	59.0	63.8	58.0	.484	.546	.472	.95	.94	.96	N E	N E	E N E	7.62	7.40	0.55	1.873	Rain.	Str. 10.	Clear.
8	.423	.414	.487	47.0	70.9	53.2	.330	.481	.361	.98	.64	.87	N	W	W	Calm.	Calm.	3.62		Clear.	Cum. 2.	Clear.
9	.614	.472	.391	50.7	71.9	58.1	.326	.481	.389	.87	.64	.79	N E	S E	S b E	5.19	3.75	3.08		Clear.	Str. 2.	Cum. Str. 4.
10	.305	.321	.429	52.7	63.4	50.0	.373	.388	.326	.93	.67	.87	S W b W	W	W	11.75	11.25	8.22	0.420	Cum. Str. 8.	Cum. 4.	Clear.
11	.460	.437	.457	49.1	56.0	46.2	.312	.287	.303	.86	.62	.94	W N W	W N W	W b N	3.25	8 83	5.37		Cum. Str. 3.	Cum Str. 8.	Clear.
12	.537	.427	.427	41.0	64.6	54.1	.264	.357	.349	.96	.59	.81	S W b S	W S W	W S W	2.19	7.12	9.30		Clear, 1st Frost.	Cum. Str. 2	Clear, A. Borealis.
13	.320	.210	.233	52.0	72.1	62.2	.349	.523	.499	.87	.67	.89	W b S	W S W	W	6.29	9.50	6.25		Clear.	Cum. Str. 4.	Clear, A. Borealis.
14	.233	.170	.169	56.8	68.0	55.2	.432	.523	.418	.94	.76	.91	N E b E	N E b E	N E b E	3.53	1.00	8.75	0.150	Str. 4.	Str. 4.	Rain b. at 5.10 p.m
15	28.925	28.911	29.079	52.0	54.0	57.1	.382	.400	.450	.96	.93	.96	N E b E	N N b E	N N E	18.36	15.29	13.87	4.992	Rain.	Rain ceased 5. 40.	Str. 9.
16	29.275	29.237	.280	51.0	72.0	67.4	.372	.607	.447	.96	.78	.94	N	S W b S	N E b N	0.76	9.07	1.38		Clear.	Cir. Cum. Str. 4.	Cum. St. 7.
17	.296	.140	.243	50.7	65.6	60.0	.349	499	.467	.93	.80	.89	N E b E	N E b E	S E	10.00	6.62	4.62		Cir. Str. 10.	Cir. Cum. Str. 9.	Cirr. Cum. Str. 9.
18	.220	.176	.145	60.5	73.6	68.3	.494	.659	.646	.94	.82	.94	S E	S E	S b E	1.12	0.93	5.42		Cir. Str. 9.	Cum.Str.9.thund'r	Cir. 2 A. Borealis.
19	.140	.068	.093	68.5	92 6	68.2	.646	.854	.523	.94	.62	.76	S	S	W N W	5.43	8.75	6.25		Clear.	Light Cum.	Cir. Str. 8.
20	.223	.218	.222	58.6	70.5	56.4	.462	.628	.432	.94	.86	.94	W	S W	S S W	6.30	2.10	1.10	0.200	Cum. Str. 10.	Cum. Str.	Cir. Str. 2.
21	.203	.142	.179	56.5	71.3	55.0	.432	.481	.394	.94	.64	.88	E S E	N E b E	N N W	0.12	1.62	1.67	Inap.	Slight Rain.	Cum. 1.	Clear.
22	.161	.138	.201	54.6	68.1	50.2	.400	.523	.326	.93	.76	.87	N E b N.	W b S	W N W	2.80	1.25	4.30		Cir.Cum. Str. 8.	Cum. Str. 2.	Clear.
23	.267	.263	.218	46.5	69.6	52.0	.303	.541	.382	.93	.76	.96	W N W	W b S	S W	1.07	1.30	1.87		Clear.	Clear.	Clear.
24	.107	.033	.277	50 0	64.3	42 6	.319	.504	.225	.93	.84	.79	S E b S	S W b W	W N W	2.75	7.63	15.41	0.303	Clear.	C. S. 6. Showers.	Clear, f't Aurora.
25	.405	.358	.452	40 0	52.7	39.8	.227	.264	.234	.85	.66	.91	W	W	W b N	7.75	11 90	8.01		Clear.	Clear, with hail	Clear.
26	.543	.505	.487	39.7	43.0	35.5	.234	.272	.210	.91	.92	.91	W b N	W b N	W N W	3 85	6 25	5.62	0.100	Cir. Cum. 4.	Overcast.	Shower'd 6.50 p.m
27	.495	.304	.365	36.0	45.2	41.8	.210	.272	.243	.91	.86	.86	N E	E N E	N E b E	6.25	6.33	2.50		Str. 10.	Str. 10.	Str. 10.
28	.190	.237	.356	41.8	41.8	40.6	.213	.263	.264	.86	.92	.96	N E b E	N E b N	N E b N	12.42	14.50	11.89	1.843	Rain began 10.20	Rain ceas'd 5.20 P	Clear.
29	.508	.500	.502	33.0	56.0	37.0	.187	.385	.218	.90	.84	.91	N N E	S E b E	S E b E	2.82	2 03	1.37		Clear.	Clear.	Clear.
30	.460	.318	.282	28.3	59.0	45 6	.119	.315	.235	.68	.61	.74	E S E	S. W.	W b S	0 03	0.73	1.56		Clear.	Clear.	Clear.

Barometer.	Highest, the 2nd day - - - - -	29.652
	Lowest, the 15th day - - - - - -	28.911
	Monthly Mean, - - - - - -	29.325
	" Range - - - - - - -	0.741
Thermometer	Highest, the 19th day - - - -	94.°0
	Lowest, the 30th day - - - -	27.°3
	Monthly Mean - - - - - -	58.°04
	" Range - - - - - -	66.°7

Greatest Intensity of the Sun's Rays—143.°0

Lowest point of Terrestial Radiation 26.°1.

Mean of Humidity, 834.

Rain fell in 11 days amounting to 10.117 inches, and was accompanied by thunder and Lightning on two days.

Yellow matter was observed to have fallen on the 24th day.

Amount of Evaporation—2.23 inches.

Most Prevalent wind—N. E. by E.

Least do. do. N.

Most Windy Day—the 15th day, mean—12.51 miles per hour

Least Windy Day—1st day, mean—0.07 miles per hour.

Aurora Borealis visible on 6 nights, and might have been seen on 14 nights.

The amount of Rain during the month has been very great, and during the incessant rain of the 15th, which lasted 24 hours, fell to the depth of 5.142 inches.

First Frost on the morning of 12th day.

The electrical state of the atmosphere has been marked *generally* by very feeble intensity of a Positive character, and during the thunder storms, the Electrometer indicated low tenson of a negative character.

Winter Phenomena in the St. Lawrence.*

The island of Montreal stands at the confluence of the rivers Ottawa and St. Lawrence, and is the largest of several islands splitting up these mighty streams, which cannot be said to be thoroughly mingled until they have descended some miles below the whole cluster. The rivers first come in contact in a considerable sheet of water called Lake St. Louis, which separates the upper part of the Island of Montreal from the southern main. But though the streams here touch, they do not mingle. The waters of the St. Lawrence, which are beautifully clear and transparent, keep along the southern shore, while those of the Ottawa, of a darker aspect, though by no means turbid, wash the banks of the island; and the contrast of colour they present strongly marks their line of contact for many miles.

Lake St. Louis is at the widest part about six miles broad with a length of twelve miles. It gradually narrows towards the lower end, and the river as it issues from it, becoming compressed into the space of half a mile, rushes with great violence down the rapids of Lachine, and although the stream is known to be upwards of eight feet deep, it is thrown into huge surges of nearly as many feet high as it passes over its rocky bottom, which at this spot is composed of layers of trap extending into floors that lie in successive steps.

At the termination of this cascade the river expands to a breadth of four miles, and flows gently on, until it again becomes cramped up by islands and shallows opposite the city of Montreal. From Windmill Point and Point St. Charles above the town, several ledges of rock, composed of trap lying in floors, which in seasons of low water are not much below the surface, shoot out into the stream about 1000 yards: and similar layers pointing to these come out from Longueuil on the opposite shore. In the narrow channel between them, the water, rushing with much force, produces the Sault Normand, and cooped up, a little lower down by the island of St. Helen and several projecting patches of trap, it forms St. Mary's current.

The interval between St. Helen and the south shore is greater than that between it and Montreal; but the former is so floored and crossed by hard trap rocks that the St. Lawrence has as yet produced but little effect in wearing them down, while in the latter it has cut out a channel between thirty and forty feet deep, through which the chief part of its waters rush with a velocity equal to six miles per hour. It is computed that by this channel alone upwards of a million of tons flow past the town every minute.

Between this point and Lake St. Peter, about fifty miles down, the river has an average breadth of two miles, and proceeding in its course with a moderate current, accelerated or retarded a little, according to the presence or absence of shoals—it enters the lake by a multitude of channels cut through its delta, and forming a group of low flat alluvial islands.

The frosts commence about the end of November, and a margin of ice of some strength soon forms along the shores of the river and around every island and projecting rock in it: and wherever there is still water it is immediately cased over. The wind, acting on this glacial fringe, breaks off portions in various parts, and these proceeding down the stream constitute a moving border on the outside of the stationary one which, as the intensity of the cold increases, is continually augmented by the adherence of the ice sheets which have been coasting along it: and as the stationary border thus robs the moving one this still further outflanks the other, until in some part the margins from the opposite shores nearly meeting, the floating ice becomes jammed up between them, and a night of severe frost forms a bridge across the river. The first ice bridge below Montreal is usually formed at the entrance of the river into Lake St. Peter, where the many channels into which the stream is split up greatly assist the process.

As soon as the winter barrier is thrown across, (generally towards Christmas,) it of course rapidly increases by stopping the progress of the downward floating ice, which has by this time assumed a character of considerable grandeur, nearly the whole surface of the stream being covered with it, and the quantity is so great, that to account for the supply many, unsatisfied with the supposition of a marginal origin, have recourse to the hypothesis that a very large portion is formed on and derived from the bottom of the river where rapid currents exist.

But whatever its origin, it now moves in solid and extensive fields, and wherever it meets with an obstacle in its course the momentum of the mass breaks up the striking part into huge fragments that pile over one another: or if the obstacle be stationary ice, the fragments are driven under it, and there closely packed. Beneath the constantly widening ice barrier mentioned, an enormous quantity is thus driven, particularly when the barrier gains any position where the current is stronger than usual. The augmented force with which the masses then move, pushes and packs so much below that the space left for the river to flow in is greatly diminished, and the consequence is a perceptible rise of the waters above, which indeed from the very first taking of the "bridge" gradually and slowly increases for a considerable way up.

There is no place on the St. Lawrence where all the phenomena of the taking, packing and shoving of the ice are so grandly displayed as in the neighbourhood of Montreal. The violence of the currents is here so great, and the river in some places expands to such a width, that whether we consider the prodigious extent of the masses moved or the force with which they are propelled, nothing can afford a more majestic spectacle or impress the mind more thoroughly with a sense of irresistible power. Standing for hours together upon the bank overlooking St. Mary's current, I have seen league after league of ice crushed and broken against the barrier lower down, and there submerged and crammed beneath. And when we reflect that an operation similar to this occurs in several parts from Lake St. Peter upwards, it will not surprise us that the river should gradually swell.

By the time the ice has become stationary at the foot of St. Mary's current, the waters of the St. Lawrence have usually risen several feet in the harbour of Montreal, and as the space through which this current flows affords a deep and narrow passage for nearly the whole body of the river, it may well be imagined that when the packing here begins the inundation rapidly increases. The confined nature of this part of the channel affords a more ready resistance to the progress of the ice while the violence of the current brings such an abundant supply and packs it with so much force that the river dammed up by the barrier which in many places reaches to the bottom, attains in the harbour a height usually twenty, and sometimes twenty-five feet above its summer level; and it is not uncommon between this point and the foot of the current, within the distance of a mile, to see a difference in elevation of several feet which undergoes many rapid changes, the waters ebbing or flowing according to the amount of impediment they meet with in their progress from submerged ice.

It is at this period that the grandest movements of the ice occur. From the effect of packing and piling, and the accumulation of the snows of the season, the saturation of these with water and the freezing of the whole into a solid body, it attains the thickness of ten to twenty feet and even more: and after it has become fixed as far as the eye can reach, a sudden rise in the water (occasioned, no doubt, in the manner mentioned) lifting up a wide expanse of the whole covering of the river so high as to free and start it from the many points of rest and resistance offered by the bottom, where it had been packed deep enough to touch it, the vast mass is set in motion by the whole hydraulic power of this gigantic stream. Proceeding onward with a truly terrific majesty it piles up over every obstacle it encounters; and when forced into a narrow part of the channel, the lateral pressure it there exerts drives the bordage up the banks where it sometimes accumulates to the height of forty or fifty feet. In front of the town of Montreal there has lately been built a magnificent revetment wall of cut limestone to the height of twenty-three feet above the summer level of the river. This wall is now a great protection against the effects of the ice. Broken by it, the ice piles on the street or terrace surmounting it, and there stops; but before the wall was built, the sloping bank guided the moving mass up to those of gardens and houses in a very dangerous manner, and many accidents used to occur. It has been known to pile up against the side of a house distant more than 200 feet from the margin of the river, and there break in at the windows of the second floor. I have seen it mount a terrace garden twenty feet above the bank, and crossing the garden enter one of the principal streets of the town. A few years before the erection of the revetment wall, a friend of mine, tempted by the commercial advantages of the position, ventured to build a large cut stone warehouse. The ground floor was not more than eight feet above the summer level of the river. At the taking of the ice, the usual rise of the water of course inundated the lower story and the whole building becoming surrounded by a frozen sheet, a general expectation was entertained that it would be prostrated by the first movement. But the proprietor had taken a very simple and effectual precaution to prevent this. Just before the rise of the waters he securely laid against the sides of the building at an angle of less than 45°, a number of stout oak logs a few feet asunder. When the movement came the sheet of ice was broken, and pushed up the wooden inclined plane thus formed, at the top of which, meeting the wall of the building, it was reflected into a vertical position, and falling back in this manner, such an enormous rampart of ice was in a few minutes placed in front of the warehouse as completely shielded it from all possible danger. In some years the

* Contributed to the Geological Society of London, June 15th, 1842, by W. E. Logan, Esq., Provincial Geologist.

ice has piled up nearly as high as the roof of this building. Another gentleman, encouraged by the security which this warehouse apparently enjoyed, erected one of great strength and equal magnitude on the next water lot, but he omitted to protect it in the same way. The result might have been anticipated. A movement of the ice occurring, the great sheet struck the walls at right angles and pushed over the building as if it had been a house of cards. Both positions are now secured by the revetment wall. Several movements of the grand order just mentioned occur before the final setting of the ice, and each is immediately preceded by a sudden rise of the river. Sometimes several days, and occasionally but a few hours will intervene between them, and it is fortunate that there is a criterion by which the inhabitants are made aware when the ice may be considered at rest for the season; and when it has, therefore, become safe for them to cut their winter roads across its rough and pinnacled surface. This is never the case until a longitudinal opening of some considerable extent appears in some part of St. Mary's current. It has embarrassed many to give a satisfactory reason why this rule, derived from the experience of the peasantry, should be depended on. But the explanation is extremely simple. The opening is merely an indication that a free subglacial passage has been made for itself by the water through the continued influence of erosion and temperature, the effect of which where the current is strongest has been sufficient to wear through to the surface. The formation of this passage shows the cessation of a supply of submerged ice, and a consequent security against any further rise of the river to loosen its covering for any further movement. The opening is thus a true mark of safety. It lasts the whole winter, never freezing over, even when the temperature of the air reaches 30° below zero of Farenheit; and from its first appearance the waters of the inundation gradually subside, escaping through the channel of which it is the index. The waters seldom or never, however, fall so low as to attain their summer level; but the subsidence is sufficiently great to demonstrate clearly the prodigious extent to which the ice has been packed, and to show that over great occasional areas it has reached to the very bottom of the river. For it will immediately occur to every one that when the mass rests on the bottom its height will not be diminished by the subsidence of the water, and that as this proceeds, the ice according to the thickness which it has in various parts attained, will present various elevations after it has found a resting place beneath until just so much is left supported by the stream as is sufficient to permit its free escape. When the subsidence has attained its maximum, the trough of the St. Lawrence, therefore, exhibits a glacial landscape undulating into hills and valleys that run in various directions, and while some of the principal mounds stand upon a base of 500 yards in length by a hundred or two in breadth, they present a height of ten to fifteen feet above the level of those points still supported in the water.

Mr. Good's Locomotive Engine "Toronto."

We have much pleasure in presenting our readers with a drawing of the first Locomotive Engine constructed in Canada, and, indeed, we believe, in any British Colony. The 'Toronto' is certainly no beauty, nor is she distinguished by any peculiarity in her construction, but she affords a very striking illustration of our progress in the mechanical arts, and of the growing wants of the country. The 'Toronto' was built at the Toronto Locomotive Works, which were established by Mr. Good in Oct. 1852, The order for the "Toronto" was received in February, 1853, for the Ontario, Simcoe and Huron Railroad: the Engine was completed on the sixteenth of April, and put on the track the 26th of the same month. Her dimensions are as follow: Cylinder, 16 inches diameter; stroke, 22 in.; Driving wheel, 5 ft. 6 in. diameter; length of internal fire-box, 4 ft. 6 in.; width of do, 3 ft. 5 in.; height of do, 5 ft. 0 in.; weight of Engine, 25 tons; number of tubes, 150; diameter of tubes, 2 inches.

Naturalists' Calendar for August, September and October.—Toronto, 1853.—By Wm. Couper.

		First Seen.
Choke-Cherry, *Prunus Serotina*,	(Fruit ripe,)	August 1.
Wild Grape Vine,	" "	" 27.
Wild Hazel,	" "	September 19.
Butternut, *Juglans Cinerea*,	" "	" 21.
Beechnut, *Fagus Ferruginea*.	" "	" 21.

Miscellaneous.—Passenger Pigeon, *Columba Migratoria*, (in flocks) Aug. 5. *Larvæ*, of the large Whirl Beetles, (*Gyrini*) construct cocoons of sand under logs &c., on the margin of ponds on the Peninsula opposite Toronto, in which they transform into the perfect insect, August 6. Caterpillars of a *Sphinx* (Hawkmoth) found feeding on the leaves of the Persian Lilac, entered the earth, August 8.—charged into a chrysalis, Aug. 10. Caterpillar of a *Sphinx*, (Hawkmoth) found feeding on the leaves of a Wild Grape Vine, changed into a Chrysalis between two leaves, on the surface of moist earth, Aug. 11. Wasps construct the first foundation of their nest, Aug. 11 Caterpillar of a large Hymenopterous fly (*Tenthredo*) found feeding on the leaves of the Willow, entered the earth and formed a cocoon, Aug. 15. Caterpillar of the moth *Saturnia Polyphemus* issues from the egg, Aug. 16—formed its cocoon Aug. 24.—This Caterpillar feeds on the leaves of the Soft Maple. A parasite of a lead-grey colour (*Aphis Lanata*) (?) and covered with filaments of white down, clusters round the branches of the Alder, Aug. 27. Needle Ichneumon-fly (*Pelecinus Polycerator*,) first seen, Aug. 27. Caterpillar of a *Sphinx* (Moth) found feeding on the leaves of the Plumtree, formed its cocoon between leaves, on the surface of moist earth, Aug. 27. Caterpillar of the Great Saturnia Moth, formed its cocoon, Aug. 27. Caterpillar of the Griseous Moth (*Cerura Hastulifera*) found feeding on the leaves of the Willow, constructed its cocoon on a small twig, Aug. 31.—This caterpillar is of a bright green colour, marked with brown lines, and has two tails. Swallows disappear, Sept. 10. The Upper surface of the leaves of the common Hazel separated by sociable Caterpillars of a whitish colour, Sept. 10. Walking-stick insect (*Phasma*) attains its full growth Aug. 14: Female deposits its *ova* on the surface of the earth, September 19. The leaves of the young Sugar Maples change their colour, Sept. 19.—One species is quite an ornament to the trees during the months of Sep. and Oct.—its leaves changes into a brilliant crimson. Caterpillar of a Saw-fly, (*Tenthredo Pini*) found feeding on the Pine, Sept. 19.—This insect is very destructive to the young pines—the *larvæ* from the eggs of two females will strip a tree of its foliage in four days. Aphides of the *Pinus Strobus*, Sept. 19. The Toad (*Bufo Cognatus*) hybernate in the earth, Sept. 20.

Frogs hybernate	- - - - - - -	October	11
Migration of the Blue Bird, *Saxicola Sialis*,	-	"	13
" " American Goldfinch, *Fringilla Tristis*,		"	13

Many species of Birds of Passage which remain with us during the summer months, apparently take advantage of the Indian Summer to depart from the country. The above mentioned birds migrate in flocks. The flight of the Blue-birds was in a south-west direction—the Finches appeared to be flying directly south.

Two Lizards, measuring about 7 inches in length, and covered with round orange-coloured spots, were taken from under the bark of a decayed tree on the banks of the River Don - October 15

The Musk Rat, *Fiber Zibethicus*, constructs its hut " 26

The fur of this animal constitutes an important item in our market. One man trapped one hundred and twenty-five last week.

Railway Bridge over the St. Lawrence at Montreal.*

The site selected for completing the connection between the eastern and western sections of the Canada Grand Trunk Railway by a bridre at Montreal is upon the "ledges of rock composed of the trap lying in floors," described by Mr. Logan as extending from Point St. Charles diagonally and downward across the general course of the stream to Moffatt's Island and the eastern shore at St. Lambert.

The governing point of the location is the narrow channel, (the only navigable one) abreast of Moffatt's Island, which is here only one hundred yards wide between the lines of ten feet at low water.

The distance of this single navigable channel from the Island of Montreal, measured on the proposed line of the bridge, is 5200 feet and from the southern main 4800 feet. The height of the banks on either shore is about thirty feet. By elevating the centre arch of the bridge (which spans the navigable channel) 100 feet over summer level of water, and by embanking about ten feet on the natural level at each shore, the gradient to be overcome is sixty-three feet, and as the distance in both cases is nearly a mile, it is one common on railways On account of this gradient, it is important that the bridge should be straight; and starting from the governing point—the navigable channel alluded to,—a straight line which will avoid deep water, the canal, and buildings of the city, must cross the river somewhat diagonally and strike Point St. Charles. This line, although oblique with reference to the general trend of the shores, is in reality at right angles *to the channel*. The bridge location follows the shoal water and the line of the "trap floor" through which the river has cut a passage at the navigable channel (as usual at right angles)—the course

* Extract from the Report of T. C. Keefer, Esq., C. E.

of which is *across* the general direction of the stream, and strikes toward the quays at Montreal.

Considering the "channel" as that portion of the stream having a greater depth than *nine* feet at extreme low water, the width of it on the bridge line as stated is about 360 fe[illegible] about 300 feet between the lines of ten feet water. If the cen[illegible] be executed in wood, the piers would encroach upon the "cha[illegible]" as above defined. It would be better to have the centre span upon any location 400 feet wide, which will involve a tubular beam of iron, at an additional expense of about £43,000. This additional expenditure I would recommend, as this arch will be exposed to the chimneys of passing steamers; moreover, by making it of iron it cuts off the communication in the event of fire—exposing only half the structure.

While the selection of the site has been governed by the accidental conditions of the river, it possesses a variety of advantages, which under such circumstances could hardly have been anticipated.

1st. The location is on the most direct line of connection for the Grand Trunk Railway. This road, without reference to the bridge, would on approaching the city cross the canal at the only convenient point (which is near Gregory's and above all the basins) and proceeded down to Point St. Charles for its freight terminus and for a connection with the harbour independent of the canal. The bridge line is a continuation of the main track coming down to Point St. Charles.

2nd. The line in the river runs upon a rock bottom and in more shallow water than can be found upon any other direct line crossing the St. Lawrence. It is a remarkable fact that the shoalest water to be found in the St. Lawrence below Lake Ontario is on the *last* rapid —the Sault Normand opposite Montreal.

The width of the river and consequent length of the bridge is not only counteracted by this shoal water (fully half of the whole distance being less than five feet deep,) but this width involves little disadvantage, because the distance between the only navigable channel and the shores admits of a gradient, which passing *over* the limits required for the navig tion, yet descends at once so as to strike the business level at both of these shores.

3rd. The ice seldom lodges *above* the line of the bridge, although it always does to a greater or less degree immediately below it. Nun's Island gives a direction to the current, which throws the ice against Moffatt's Island where it piles with great force. The shoal, which is suspended from the lower end of Nuns' Island to the centre channel will act as a breakwater to the western half of the bridge against the effect of "bergs" of ice. The average depth of water on this shoal not exceeding seven feet, detached ice-breakers can be constructed upon it at a moderate cost, which will break the momentum of large descending fields,—while accumulations of ice having too great a draught of water to pass under the arches will be "picked up" by this shoal before reaching the piers of the bridge. On the eastern half of the bridge, the greater portion of the work will derive much protection against the effects of descending ice, by the works of the Champlain and St. Lawrence Railway, and by the natural breastwork of Moffat's Island.

4th. The site, while it possesses all the advantages of a line in the rapids where there is but one navigable channel, not only has that channel narrower than any available one in the rapids above, but the rapid is so moderate as not to offer any great impediment to the work of erection, and construction, and for three months in the year is frozen over and accessible at every point upon strong ice.

5th. Terminating at Point Charles in immediate contiguity with the canal basins, the water level of which aided if necessary by an additional supply from the head of the Lachine rapids can be conducted over hundreds of acres both on land and in the river,—the bridge will lead all the railroads from the southern shore to the only point where they can be placed in immediate connection with the navigation and receive supplies "ex-warehouse," or direct from inland or sea craft for distribution to every part of New England or the Lower Provinces. In connection with this subject I have projected a scheme of docks around Point St. Charles, which shews the capabilities of the place in point of extent to be at least equal to that of Liverpool, Glasgow, or London, and which may be taken up in sections and extended as required for the increasing wants of commerce.

The importance of this point, its fitness for a general railway terminus in connection with the sea and inland navigation, is explained at large in the appendix in an extract from my unpublished Report on the Montreal and Kingston Railway, and also an extract from a lecture before the Mechanics Institute of this city.

It will be at once seen on reference to a map, that *the whole* of the channel between Nuns' and Montreal Islands may be filled with water and made available for the navigation. Also by obtaining (upon top of the embankment) permanent access to Nuns' Island, the outer coast of that island presents an extensive frontage and deep water where barges and lake and river craft not drawing over nine feet water may load for ports below.

It is only by an artificial harbor accommodation like this that Montreal can ever hope to share with Quebec any portion of the export trade in deals. Bright deals brought by railway to Point St. Charles and Nuns' Island, could afford this transportation on account of the higher price these command over those which have been floated. This trade by attracting a larger marine to this port could not fail to give an important impulse to our commerce,

Lastly. The excellence of this site,—opposing only a single navigable channel which is trumpet-mouthed and therefore affords safe and easy access to the passage of the bridge,—is strikingly shown in the features of practicability, of economical arrangement. and the minimum of gradient which are here attainable.

If the navigable channel were a quarter of a mile or more in width, as it is both above and below the proposed line of the bridge, it would be necessary to elevate *all* that portion of the bridge which spanned this channel, one hundred feet. This would shorten the distance in which the ascent from the shore to the highest point of the bridge must be made, so as either to increase the gradient to an impracticable figure or augment the cost and length of the bridge. The increased cost might make it commercially impracticable, and the increased length might throw the terminus on shore at a point which would greatly damage if not destroy its commercial usefulness. Again, if there were *several* navigable bays under the bridge these would be separated by piers splitting the current, so as to make the navigation dangerous.

The economical arrangement consists in the fact that it will only be necessary to elevate the two piers embracing the channel to the height of one hundred feet above the water; over these a rectangular tubular beam (30 feet deep, and assisted by arches, if of wood, but without arches and of less depth if of iron) will be laid—*through* which the trains will run The piers immediately on either side of these central ones will only be raised seventy feet above the water, and from these toward either shore the height of the piers will gradually diminish, in proportion to the gradient of the bridge. The trains will run *upon the top* of the bridge in ascending from either shore to the centre arch, and the depth of the tubes (thirty feet) will, *without additional cost,* make up so much of the required elevation of the track, and thus be a substitute for a corresponding amount of masonry in the piers. This dropping of the bridge immediately on either side of the centre span is here admissable—because no masted craft will pass under the side arches—but would obviously be inadmissable if the navigable channel extended over a greater portion of the river.

The comparative lightness of the gradient is due to the existence of of the single narrow channel and its position nearly in the centre of the bridge line, from the combined effects of which the greatest possible distance is obtained for surmounting the level between the shores and summit of the bridge.

PRINCIPLES OF CONSTRUCTION.

In the foregoing part of this report, the plan of the proposed bridge has been partly developed, but in consequence of its relation to the action of the ice, its peculiar position and arrangement, it will be necessary to allude to it more fully.

The importance of retaining the "bordage" ice *in situ* has been explained, and for this purpose, that part of the bridge extending from the shores over the shoals, to the depth of five feet water, being a distance of 450 yards on one side, and 570 on the other, is designed to be a solid causeway or embankment carried above the level of the highest winter flood; from which point to the level of the rails it may be carried up by a viaduct of arches—an embankment or trestle work for the present. If the scheme of docks which I have proposed at Point St. Charles, be carried out, this causeway would become one of the dock walls, and the arches erected on it to give the proposed ascent to the bridge might be converted into warehouses. If the channel between Nun's Island and Point St. Charles be dammed, an immense amount of ice which now goes down to aid in flooding the water back on Montreal, would be retained harmless until it melted in the spring

On the south-eastern shore the great width and dead shoal water around the Laprairie basin, form square miles of ice, which, so soon as freed from its attachment to the shore, is carried by the throw of the current directly down through the *now* important channel between Moffatt's Island and the St. Lembert side. The works of the Champlain and St. Lawrence Railroad Company, although incomplete and not high enough, retained this bordage *in situ* during last winter, (1851 —1852) and this in connection with the fact that the winter set in

except of tracts promising profitable veins of lead, of copper, or one of the precious metals.*

The coal-measures of Iowa are shallow, much more so than those of the Illinois coal-field. They seem attenuated, as towards the margin of an ancient carboniferous sea, not averaging more than fifty fathoms in thickness. Of these the productive coal-measures are less than a hundred feet thick. The thickest vein of coal detected in Iowa does not exceed from four to five feet; while, in Missouri, some reach the thickness of twenty-five feet and upwards.

In quality, the coal is on the whole inferior to the seams of the Ohio Valley. To this, however, some very fair beds form exceptions.

On the Mankato and its branches, several pieces of lignite were picked up from the beds and banks of the streams. Some of this lignite approaches in character to cannel coal; but most of it has a brown colour, and exhibits distinctly the ligneous fibre, and other structure of the wood from which it has been derived. Diligent search was made to endeavour to trace this mineralized wood to its source, and discover the valuable coal-field. At one point a fragment was found seventy feet above the level of the river, projecting from the drift, but no regular bed could be detected anywhere, even in places where sections of the drift were exposed down to the magnesian limestone.—The conclusion at which those gentlemen who were appointed to investigate this matter arrived was, that the pieces occasionally found throughout the Minnesota conntry are only isolated fragments disseminated in the drift, but that no regular bed exists within the limits of the district.

The occurrence of strata of brown coal, earthy coal, and bituminous coal and slate, on the west side of Great Bear Lake, as reported by Dr. Richardson, overlying a vast region of magnesian limestone, like those of Iowa and Wisconsin, rendered it possible that this lignite might be found in partial beds also on the Mankato; nevertheless, the observations of the subcrops on that stream do not leave any hope of the existence of even such local carbonaceous deposits. On the contrary, it appears most probable that the pieces found have been transported from the north along with the drift, perhaps from their very beds on the Great Bear Lake; or from the creta'eous or supercretaceous lignite formations which were observed by Nicolet, and others, off towards the Missouri and Rocky Mountains.

In further support of this view of the origin of the lignite of the Minnesota country, I may add that, every piece and fragment which the members of the sub-corps could find was collected and brought away, all of which when put together and weighed, did not exceed ten pounds.

From the confluence of the Waroju, to the mouth of the Red Wood River, which is as far up as the country was explored, different varieties of crystalline rocks, alone, make their appearance, varying in height from a few feet to a hundred and twenty-five feet. After passing Little Rock, twelve principal exposures are seen immediately on the bank of the river, in the distance of eighty miles, the intervals being covered by alluvium and drift, which hides them from view.—The principal varieties are granites and hornblendic rocks, with occasional syenite. No traces of metallic veins worthy of note were observed traversing these formations. In the granite, eight miles below the Red Wood River, some specular iron was found, but only in thin crusts in the joints of the rocks

The only mineral that promises to be of much value in this region of country is a bed of nodular iron stone, found at a number of localities both on the Mankato and Lesueur Rivers, at the base of the drift, resting either on the magnesian limestone or sandstone. This a[illegible]aceous bed of carbonate and hydrated brown oxide of iron, varies from one to three feet in thickness.

The middle division of the Iowa coal field affords, at many localities, iron stone of various qualities, associated frequently with hydraulic calcareous cement, and which occurs, either in the form of disconnected *septaria*, or regular beds. In the same geological position, at many localities, crystalized selenite has been observed, which accumulates in quantity high up on the Des Moines; and finally, a few miles below its Lizard Fork, that mineral expands itself into heavy beds of gypsum, or plaster of Paris, which show themselves on both sides of the river, for the distance of about three miles, exposed in horizontal beds with a thickness of from twenty to thirty feet.

The iron stone occurs sometimes in the form concretionary nodules, sometimes in continuous bands of several inches in thickness, interstratified in the shales. In the chapter embracing the detailed description of the carboniferous rocks of Iowa, will be found the analysis of some of this iron ore, together with other more precise information regarding it.

On Soapcreek and its branches, in Davis county, where the middle divison of the coal series prevails, there are several salt springs which were tested qualitatively on the spot, and found to contain a portion of common salt (chloride of sodium). The amount of the precipitated chloride of silver, as well as the taste of the water, indicated, however, only a weak brine. By boring, a stronger water might possibly be obtained; nevertheless, the shallowness of these coal measures, the frequent rupture of the strata and consequent local reversion of the dip, together with the fact of the lowest division being composed chiefly of limestone instead of sandstone, are unfavourable indications of the existence of deep-seated brine, or of nests of salt, whence the percolating waters might become saturated and carry the saline matter to the surface.

Though deficient in productive minerals, such as are reserved by the Land Office, a large proportion of this district consists of rich fertile soil, well adapted to all agricultural purposes. Of such is a large portion of the Iowa coal field; and the region lying north both of that and the Illinois coal field, as far as the falls of the eastern tributary of the Mississippi. Some of the lands of the Des Moines and Cedar Rivers can be scarcely excelled for fertility, perhaps, in the world.

On the other hand there are portions of the district, chiefly in the vicinity of the sources of the Black and Chippewa Rivers, and of the streams flowing north into Lake Superior, which are, in part so hopelessly arid that, in our generation, they will assuredly never be purchased or occupied; in part so covered with erratic boulders that the traveller can step from one to the other for miles, without setting foot on the drift soil on which they lodge, and that a bridle path for a pack horse cannot be picked out over the country they cover; in part, again so intersected by ponds and swamps, that fish, frogs and water fowl must, in our day at least, be their only inhabitants.

In conformity with my instructions, I have heretofore, from time to time, reported to the Department what portion of these lands are so wholly worthless as not to justify, in my judgment, the expense of sectionizing or surveying at all, except so far as may be necessary to connect the surrounding surveys. These refuse lands amount to fifteen thousand miles. If, in consequence of the recommendation thus made they are excepted from the linear surveys which are usually extended by the Government over all its Indian purchases, without examination or inquiry, the saving to the Land Office will much over-pay the entire cost of the survey, the results of which I am now reporting.

A circumstance which to some may seem trivial, will delay, to a considerable extent, the settlement of a portion of the District. It is the prevalence, especially on the Upper Wisconsin, Chippewa, St. Croix and Black River countries, and thence north to Lake Superior and to the British line, of venomous insects, in such insufferable quantities, that, at certain seasons, they destroy all comfort or quiet by day or by night. Among the pineries of Northern Wisconsin, and [illegible] less throughout the whole of the above designated region, the [illegible] gnat, the *brulot** and the sandfly, to say nothing of myriads of [illegible] musquitoes, carry on incessant war against the equanimity of the unfortunate traveller. I and other members of the corps, when unprovided with the necessary defence, have had our ears swelled to two [illegible] three times their natural size, and the line of our hats marked [illegible] round by the trickling blood. It was often necessary to rise [illegible] times, in the course of the night, to allay the fever of the head, by repeated cold bathings; and, at some of the worst spots, we could scarcely have discharged our ordinary professional duties at all without the constant protection of musquito-netting worn over our head and face.

The health, even of the more marshy portions of the District, seems better than, from its appearance, one might expect. The long, bracing winters of these northern latitudes exclude many of the diseases which under the prolonged heat of a more southern climate, the miasm [illegible] swamp engenders. Perhaps the healthiest portion of the whole district is along its northern limit, where it is continuous to the British dominions. At the Pembina settlement, owned by the Hudson's Bay Company, to a population of five thousand there was but a single physician; and he told me that, without an additional salary allowed him by the Company, the diseases of the settlement would not afford him a living. * * * * * *

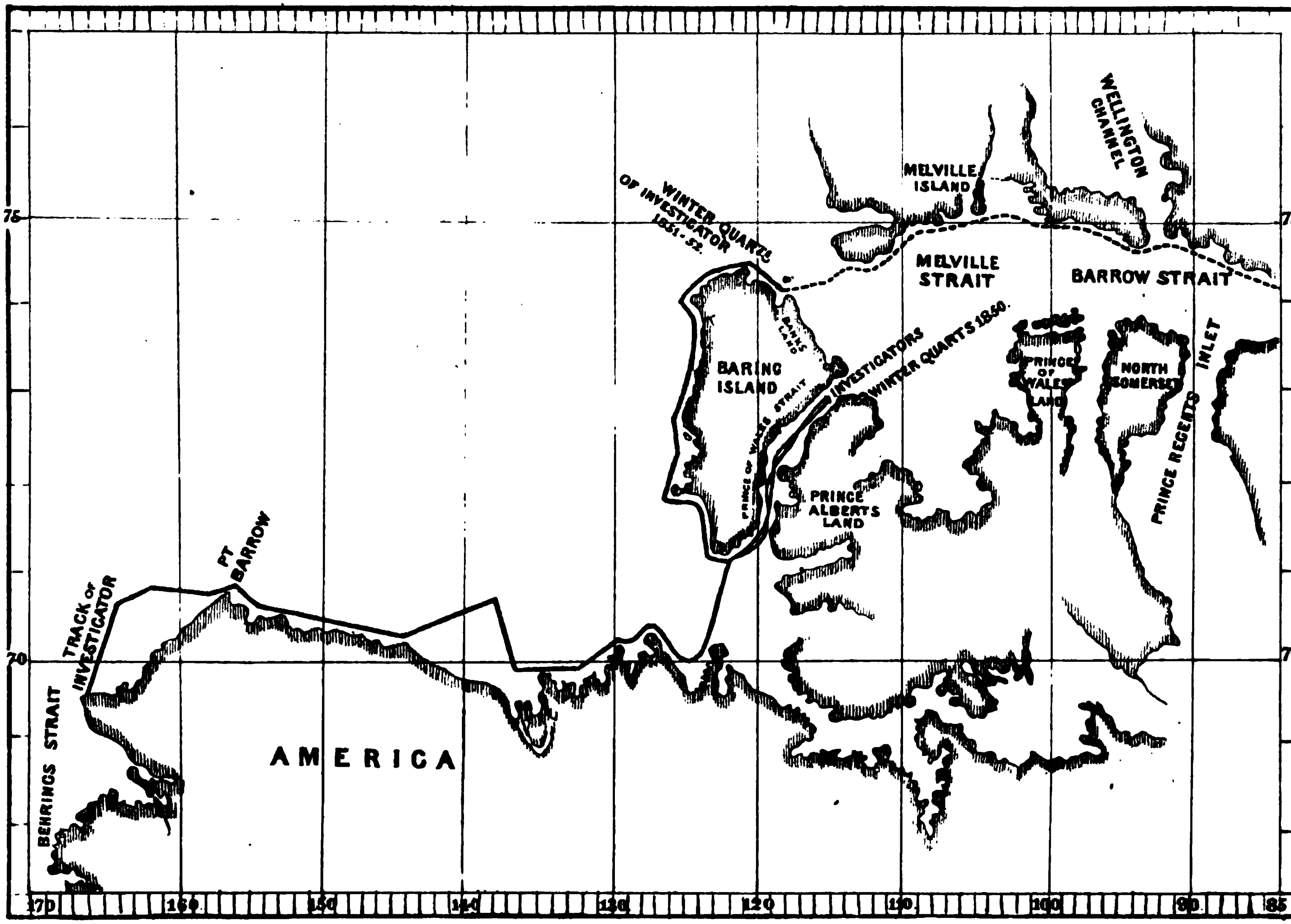
Before starting on the expedition, I had obtained from Mr. John F. Crampton, of the British Legation at Washington, a letter commending me to the good offices of the officers of the Hudson's Bay Company, and which procured for us [illegible] hospitable reception at the settlement.

On our arrival at the m[illegible] of the Assibiboin, Governor Chris[illegible] then acting as Superintendent of affairs of the Hudson's Bay Company, and Governor of the Colony, invited us to make his house our h[illegible] during ou[illegible] stay on Red River, and entertained us in the kindest manner. I have to acknowledge the attentions paid to our party by the officers stationed both at the Upper and Lower Forts.

(*To be Continued.*)

* A rich vein of lead ore, traversing the Lower Magnesian Limestone, was discovered on the "Half-breed Tract," south of Lake Pepin; but this being an Indian cession, it was not reported to the Department for reservation.

* So called by the voyageurs *bruler*, to burn; the sting producing a burning sensation.



WELLINGTON CHANNEL
MELVILLE ISLAND
WINTER QUARTS OF INVESTIGATOR 1851-52.
MELVILLE STRAIT
BARROW STRAIT
BANKS LAND
BARING ISLAND
PRINCE OF WALES STRAIT
INVESTIGATORS WINTER QUARTS 1850.
PRINCE OF WALES LAND
NORTH SOMERSET
PRINCE REGENTS INLET
PRINCE ALBERTS LAND
PT BARROW
TRACK OF INVESTIGATOR
BEHRINGS STRAIT
AMERICA
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85

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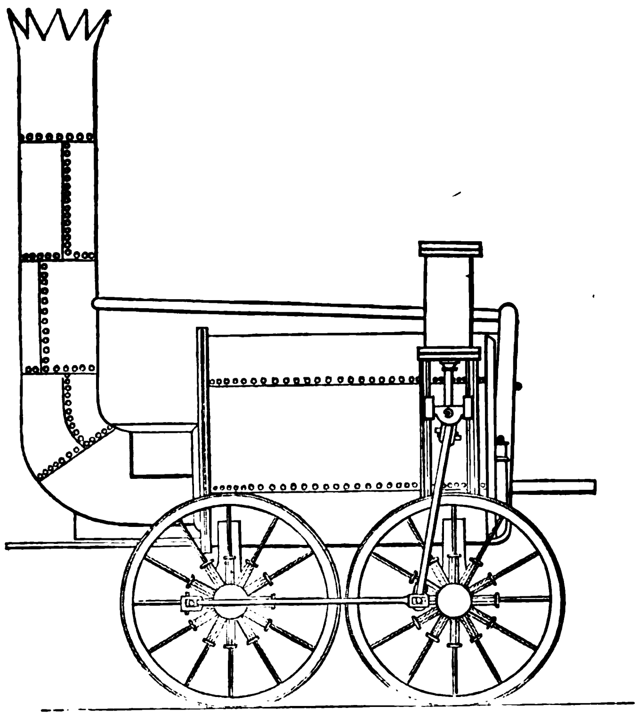
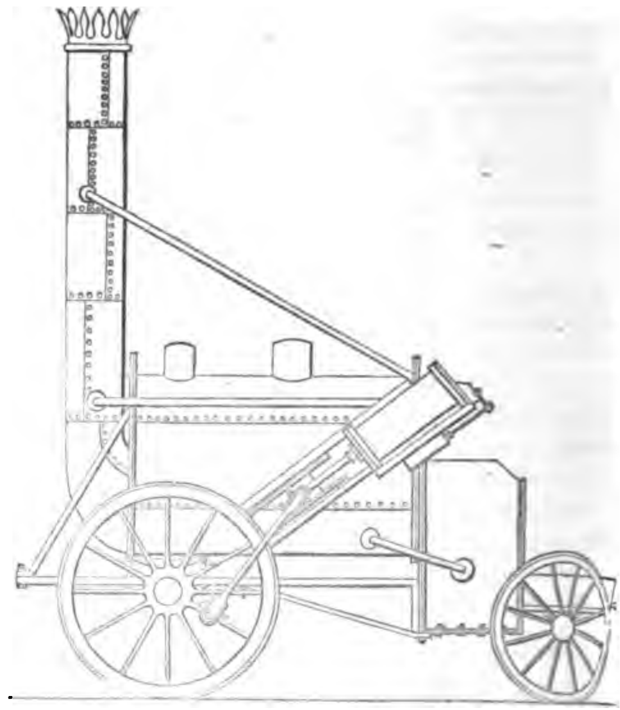
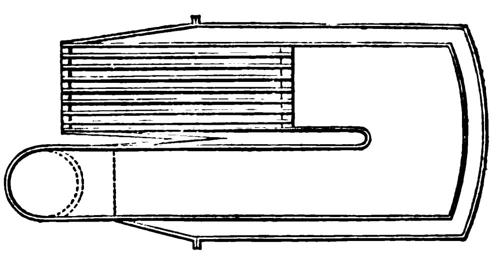


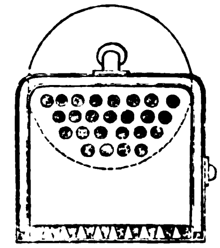
"THE SANSPAREIL"—By Hackworth.



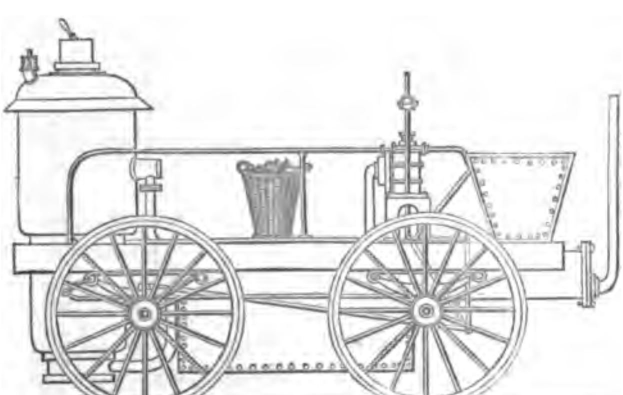
"THE ROCKET"—By Stephenson.



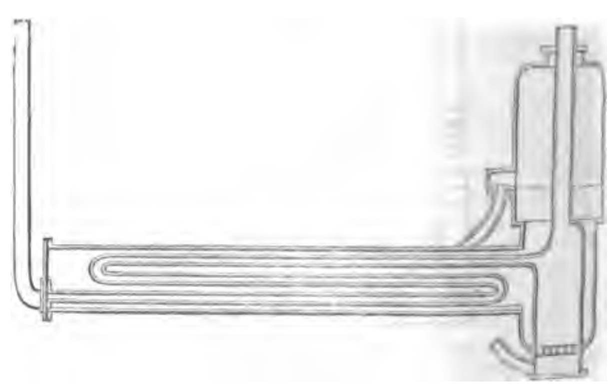
Plan of the Boiler of the "Sanspareil."



Section through the Boiler of the "Rocket."



"THE NOVELTY"—By Ericson.



Section through the Boiler of the "Novelty."

The Canadian Journal.

TORONTO, NOVEMBER, 1853.

The Annual Report of the Superintendent of the Coast Survey, [U. S.] Showing the Progress of that work during the year 1851, pp. 558, accompanied by a Quarto Volume, Map and Chart.

This Report with its voluminous appendices, contains a variety of official documents relating to the Coast Survey of the United States, many of which have no interest for the general reader, while others will attract universal attention. The extracts from the report of Professor Agassiz, to the Superintendent of the Coast Survey, on the examination of the Florida reefs, keys and coast, contain most interesting information respecting the formation, progress and decline of the coral reefs. A portion of these we subjoin.

On page 227 of the 1st Volume of this Journal will be found the elaborate report of George Mathiot, Electrotypist, on the electrotyping operations of the United States Coast Survey, which forms the concluding portions of this important and elaborate work.

MODE OF FORMATION OF THE CORAL REEF.

The reefs of Florida as they have been described in the foregoing sketch of the topography of that state, and, indeed, the separate parts of each of these reefs, in their extensive range from north-east to south-west, present such varieties as will afford, when judiciously combined, a complete history of the whole process of their formation.

Here we have groups of living corals, beginning to expand at considerable depth, and forming isolated, disconnected patches, the first rudiments, as it were, of an extensive new reef. There we have a continuous range of similar corals in unbroken continuity for miles, or even hundreds of miles, rising at unequal heights nearly to the surface.

Here and there a few heads or large patches, or even extensive flats of corals, reach the level of low water mark, and may occasionally be seen above the surface of the waters, when the sea is more agitated than by the simple action of the tides. In other places coral sands or loose fragments of corals, larger or smaller boulders, detached from lower parts of the living reef, are thrown upon its dying summits, and there form accumulations of solid material, rising permanently above low water mark; collected sometimes in such quantities and at such heights as to remain dry, stretching their naked heads above high water.

In other places these accumulations of loose, dead materials have entirely covered the once living corals, as far as the eye can reach into the depth of the ocean: no sign of life is left, except perhaps here and there an isolated bunch of some of those species of corals which naturally grow scattered, or of those other organisms which congregate around or upon coral reefs; but the increase of the reef by the natural growth of the reef-building corals is at an end. Again, in other places, by the further accumulation of such loose materials, and the peculiar mode of aggregation which results from the action of the sea upon them, and which will be more fully explained hereafter, extensive islands are formed, ranging in the direction of the main land, which support them. Elsewhere we may find the whole extent of the reef thus covered, while, after a still more protracted accumulation, perhaps becomes united with some continental shore.

Now, it must be obvious, that from a comparison of so many separate stages of the growth of a coral reef, a correct insight may be obtained into the process of its formation; and, indeed, in thus alluding to the different localities which came under our own observation, we have already given a general history of its progress, which we now proceed to illustrate more in detail.

We would, however, first remark, that the extraordinary varieties which exist in the natural condition of different parts of the same reef, or of different reefs, when compared with each other, fully explain the discrepancies between the reports which have been obtained, respecting the reefs of Florida, prior to our investigations.

It had been stated that the reefs consisted solely of living corals; and, indeed, this report is true of the outer reef, which is called by all the inhabitants of Florida "*the reef,*" *par excellence*, and is unfounded only with regard to those few islands which rise above the surface of the sea at Sand Key and the Sambos. Others, who had noticed only the larger accumulations of coral fragments which occur on the shores of some islands forming part of the Florida reef, had reported the islands to be formed of coral rocks; while some who had, perhaps, observed the extensive excavations made around Key West, have told us only of the existence of oolitic and compact rocks, almost destitute of corals or other remains of animal life; and from still other localities comes the opinion, that the rocks consist of nothing but more or less disintegrated shells, cemented together.

ON ANIMAL LIFE.

* * * * * * * * * * *

The fullness and variety of animal life is particularly obvious within the boundaries of coral fields, the natural limits assigned to the growth of these animals being those in which animals of other classes range in greater profusion, and the coral reefs themselves also affording very favourable circumstances for the display of numerous living forms. Hence the extraordinary assemblage of all classes of animals upon the reef, where, besides those particular kinds of corals which contribute largely to its formation, we find upon it, or on the foundation from which it rises, a great variety of other corals, which, though too insignificant in size to take a conspicuous part in building up these extensive accumlations of organic lime-work, add none the less their small share in the work, contributing especially to fill up the vacant spaces left by the more rapid and durable growth of the larger kinds. They are to the giants of the reef what the more slender parts are to the lords of the forest, adding the elegance and delicacy of slighter forms to the strength, power, and durability of their loftier companions.

But besides the stony corals, we find in the reef a great variety of soft polyps, either attached to the surface of dead corals, dead shells, or of the naked rocks, or boring into the coral sand and mud.

* * * * * * * * * *

Such are different species of arca, the date-fish among the mollusca, and many worms, especially serpula among articulates, the agency of which in the formation of the keys will be described hereafter. All these animals and plants contribute, more or less, to augment the mass of solid materials which is accumulating upon the reef, and increase its size. Not only are the hard parts of shells, echinoderms, worms, or their broken fragments, heaped among the detritus of the corals, but occasionally even the bones of fishes and turtles, which are very numerous along the reef, may be found in the coral formations.

The decaying soft parts of all these animals undoubtedly have their influence upon the chemical process, by which the limestone particles of their solid frame are cemented together, in the formation of compact rocks. Upon this point we may expect further information from Professor Horsford, who is now submitting to chemical analysis all the variety of rocks and the solid stems of the different corals obtained in Florida.

Respecting the relations of the solid and soft parts of the living coral, and their mode of growth, we would refer to a paper of ours now in press, to appear in the next volume of the Smithsonian Contributions to Knowledge.

CORAL REEFS.

After examining a growing coral reef, so full of life, so fresh in appearance, so free from heterogeneous materials, in which the corals adhere so firmly to the ground, or if they rise near the surface, seem to defy the violence of the ocean, standing uninjured amid the heaviest breakers, an observer cannot but wonder why in the next reef, the summit of which begins to rise above the level of the water, the scene is so completely changed. Huge fragments of corals, large stems, broken at their base, gigantic boulders, like hemispheres of Porites and Macandrina, lie scattered about in the greatest confusion; flung pell mell among the fragments of more delicate forms, and heaped upon those vigorous madrepores which reach the surface of the sea.

The question at once arises, how is it that even the stoutest corals, resting with broad base upon the ground, and doubly secure from their spreading proportions, become so easily a prey to the action of the same sea which they met shortly before with such effectual resistance? The solution of this enigma is to be found in the mode of growth of the corals themselves. Living in communities, death begins first at the base or centre of the group, while the surface or tips still continue to grow, so that it resembles a dying centennial tree, rotten at the heart, but still apparently green and flourishing without, till the first heavy gale of wind snaps the hollow trunk, and betrays its decay. Again, innumerable boring animals establish themselves in the lifeless stem, piercing holes in all directions into its interior like so many augurs, dissolving its solid connexion with the ground, and even penetrating far into the living portion of these compact communities. The number of these boring animals is quite incredible, and they belong to different families of the animal kingdom: among the most active and powerful we would mention the date fish, lithodomus, several saxicava, petricola, arca, and many worms, of which the serpula is the largest and most destructive, inasmuch as it extends constantly through the living part of the coral stems, especially in macandrina.

On the loose basis of a macandrina measuring less than two feet in diameter, we have counted not less than fifty holes of the date-fish—some large enough to admit a finger—besides hundreds of small holes made by worms.

But however efficient these boring animals may be in preparing the coral stems for decay, there is yet another agent, perhaps still more destructive. We allude to the minute boring-sponges which penetrate them in all directions, until they appear at last completely rotten throughout. * * * * *

The experiments of the late Sears C. Walker* on the subject of galvanic wave time, furnish very valuable information on the propagation of the electric current. The results arrived at by that distinguished astronomer are given below:—

1. That the average of all our experiments to that time (1850) indicates a velocity of propagation of the inducing waves of 15,400 miles per second in the iron wires of a telegraph line.

2. That the velocity of propagation through the ground appears to be less than two-thirds of the velocity in the iron wires.

These conclusions were in accordance with the independent results of the researches of Dr. B. A. Gould and Mr. Karl Culman, previously read, and since published in the proceedings of the American Association for the Advancement of Science, at their meeting in New Haven in August, 1850.

There have been three independent series of observations for the value of wave-time, made since October last, 1850. The first experiment was repeated on several nights, between Seaton Station and Portsmouth, Va. The distance on the iron wires is 268 miles, and the distance through the ground is 180 miles. The clock station excess, in the electrotonic readings, by a mean of 221 measures, was +0s.024, while the computed excess for the assumed velocity of 15,400 miles per second, in the iron wires, was +0s.035. The difference between theory and computation is, theory greater by +0s.011.

The second experiment was made from Charleston, S. C., to Augusta, Ga., in the winter of 1851. The distance on the iron wire from Columbia (where the Charleston end went to the

* At a meeting of the officers and members of the U. S. Coast Survey, the Superintendent, Professor A. D. Bache, delivered the following sketch of Mr. Walker's scientific attainments:—

We have met to pay our tribute of respect and feeling to one of our most distinguished and valued associates, Sears C. Walker, Esq., whose failing health for more than a year past has kept us in anxiety and fear for the result which has now come. Mr. Walker was attacked by bilious fever some weeks since; and though his mind was clear, his physical strength was not adequate to resist the effects of the disease.

The services which Mr. Walker has rendered to the coast survey are known in a general way to most of those whom I address. He had made the largest collection of American observations of moon culminations and occultations ever made in the country, and prepared to discuss them thoroughly for longitudes, and to bring them to bear, as far as applicable, by the geodetic results of the coast survey, upon the longitude of a central point. The magnitude of this labor would have appalled an ordinary mind. He knew that by perseverance it could be accomplished. During this discussion he reached the conclusion that the longitudes from moon culminations could not be reconciled with those from occultations, and that the theory must be re-examined for an explanation. His published reports show the successive steps of his investigation, which was not completed at the time of his decease. In the midst of it, the new, attractive, and important subject of determining differences of longitude by the telegraph was committed to him, and he threw all his zeal and knowledge into the solution of this problem, and brought it to the successful condition in which it now is. He early saw the impossibility of reading a near result by merely repeating the transmission and reception of signals, beats of a clock or chronometer, and that the beats sent and received must be of time-keepers regulated to different times—as, for example, mean solar and sidereal, and seized all the consequences flowing from this principle. The telegraphing of transits of stars was original with him.

He soon became satisfied of the necessity for graphic registry of the time results, and invited the co-operation of Mr. Saxton, of Mr. Bond, of Prof. Mitchell, and of Dr. Locke in the solution. With him originated the application of this method to the registry of time observations for general astronomical purposes, now developed by so many ingenious modes, and known as the "American Method." His researches on galvanic wave-time, growing out of these experiments for difference of longitude, are by far the most valuable contributions yet made to this branch of science. In this subject alone Mr. Walker accomplished a most remarkable five years' work; but this was only a part of what his mind found there to do, and, aside from this and labors of daily and nightly routine in computing and observing, he accomplished a work—investigation of the orbit and computation of an ephemeris of Neptune—which of itself would have given him an undying reputation. I cannot in this place describe how the training of a life was obtained which led to these brilliant results for our work, and for American science; nor can I trust myself now in an analysis of the mind and heart of this friend for many years. I have faintly pencilled his doings while closely connected with our work, shadowing merely his claims to our admiration, respect and gratitude.—*Republic, Feb.* 8.

ground) to Augusta, was 301 miles, and from Augusta to Savannah 146 miles, making the total connextion through the iron wire, 447 miles, and the distance through the ground from Columbia to Savannah, 135 miles. The clock was at Savannah. The arbitrary signals were given at Charleston. The observed clock excess was by 59 measures +0s.056. The computed wave-time, for the above assumed velocity, was 0s.058, leaving a difference of +0s.002.

The third experiment was made at Cincinnati, on the 9th of May last, on the occasion of the meeting of the American Association for the advancement of science. The telegraph line was composed of 840 miles of iron wire, without ground connexion. The distances were as follows: from Cincinnati to Steubenville, 295 miles; thence to Cincinnati the same; thence to Louisville 125 miles, thence to Cincinnati the same. The personal clock signals were given by Mr. Stager, chief operator, at Cincinnati. In the first experiment the arbitrary signals were given by the operator at Steubenville, and recorded at Steubenville, and also on the two registers at Cincinnati, on opposite branches of the line. These registers, I will call, respectively, Stager and Jones; Stager being the register for the clock station. The observed excesses were, for Steubenville arbitrary signals, as follows:

Stager—Steubenville........+0s.040 by 31 measures.
Stager—Jones..............÷0s.039 by 31 "

Again, for the Jones arbitrary signals, on the Stager clock scale, we found:

Stager—Steubenville.......—0s.004 by 39 measures.
Stager—Jones............+0s.050 by 226 "

The direction of the current from the platinum to the zinc, through the junction wires, was from Stager to Steubenville, thence to Jones, thence round by Louisville to Stager.

This is the first experiment made by the Coast Survey on a telegraph line of iron wire exclusively without ground connection.

The first conclusion to be drawn from this experiment is, that the excesses of the clock station readings in the experiments heretofore made, have not been owing to the fact that a part of the galvanic current has been made through the ground, since they are here found to be as great for the dimension of the line as in former experiments with the partial ground connexions.

This experiment was made with a long circuit of iron wire without ground connexion. It confirms the general conclusion respecting the value of wave time. It gives a new field for the discussion of the physical question, whether the wave is propagated round in one direction and only affects the magnets as it reaches them in succession in this direction, or whether the wave travels by the shortest direction from one magnet to another, without reference to the character of the pole. Our experiments with lines composed partly of ground and partly of iron wire stretched on poles, led to the preference of the latter view of the subject. The experiments at Cincinnati in 1851 raises some doubt on this conclusion; it was made with a single battery at Cincinnati and with 840 miles of wire all in the air. The work of this night was not as complete as I could have desired, I must therefore wait till similar experiments are made under more favourable circumstances before attempting a further examination of the question.

The Arctic Expeditions.*

The return of the Phœnix steamer,—which, our readers will remember, was despatched with a transport to convey stores to Sir E. Belcher's searching squadron—puts us in possession of intelligence from the Arctic regions of a most interesting and at the same time a very painful nature.

The leading feature of interest lies in the fact, that the problem of a passage for ships between the Atlantic and the Pacific Oceans, north of the American continent—a problem which has engaged the enterprise of maritime nations, and particularly of our own, for upwards of three centuries—has been finally solved. Capt. M'Clure has succeeded in navigating his ship from Behring's Strait, in the west, to within about sixty miles of Melville Straits,—and was, according to the last accounts, waiting only for the disruption of the ice to pass through those straits and return by the eastern outlet to England.—The problem had long since been stript of all that portion of its interest which was reflected on it from the field of commercial speculation; but its solution, after ages of such perilous adventure as that by which it has been sought, is a great scientific triumph,—and adds fresh glory to the old and famous flag of England.

In lieu of the commercial interest which once attached to this long *vexata quæstio*, none better than the readers of the *Athenæum* know how melancholy an interest of another kind has attached to the late years of adventure in these ice-bound seas:—and the painful part of the intelligence now brought home has reference to that latter subject of anxiety and suspense. The secret of ages has been yielded up at last, we have too much reason to fear, on heavy terms. The proud satisfaction which Englishmen must feel at the discovery of a North-west—or rather, North-east—passage, is clouded by the sad fact, that the intrepid conquerors of this mysterious route have come on no traces of Franklin and his unfortunate companions.

When on the eve of sailing, Capt. M'Clure emphatically declared that he would find Sir John Franklin and Capt. Crozier, —or make the North-west passage. He has, geographically speaking, redeemed the latter part of this pledge:—but the fate of those gallant Commanders and their crews is hidden yet amid the dark and labyrinthine ice-paths of the Arctic seas. The scientific secret of centuries has been wrenched at last from the Spirit of the North;—but the human secret which in these latter days the heart of more nations than our own has so yearned to solve, he guards yet, in spite of all questioning, in some one of his drear and inaccessible caves.

It will be remembered by those who have followed the history of the Arctic Expeditions in our columns, that Capt. M'Clure was first lieutenant of Sir James Ross's ship Enterprise,—and having been promoted, volunteered for the second Expedition by way of Behring's Strait. He was appointed to the command of the Investigator, under Capt. Collinson, of the Enterprise; and proceeded with that officer to Behring's Strait in the early part of 1850. Capt. Collinson having failed to penetrate the pack ice, parted from Capt. McClure, and sailed to Hong Kong, where he wintered; but the latter, notwithstanding a signal of recall from Capt. Kellett of the Herald, who was the chief officer on that station, dashed onwards with a bold determination to force a passage to the north-east,—taking on himself all the responsibility of disobeying orders. Fortunately, his daring has been crowned with success; and it is not a little singular that Captain Kellett, who was the last person seen by Capt McClure when he entered the ice on the west,—should have been the person to rescue him at the expiration of three years on the side of Melville Island on the east.

We learn from Capt. M'Clure's despatches—which are very voluminous—that on the 5th of August (1850) he rounded Point Barrow, the north-eastern extremity of Behring's Strait,—and then bore to the east, keeping near the shore. On the 9th, he passed the mouth of the Colville; and on the 11th, a notice was deposited upon Jones's Island, which was found thickly

* Athenæum.

strewed with drift wood. Here communication was held with the natives,—one of whom had a gun with the name of Barnet, and the date 1840 on the lock; and tobacco was bartered for salmon and ducks. The thievish propensity of these natives alluded to by other explorers is amply confirmed by Captain M'Clure.—Struggling on through narrow leads of water, the Pelly Islands, at the mouth of the Mackenzie, were reached on the 21st of August,—and Point Warren, near Cape Bathurst, on the 24th. Here a circumstance occurred which we should be glad to know admitted of satisfactory explanation.

It appears, that on attempting to land at the above point, two natives waved the adventurers off with threatening gestures. It was with much difficulty that they were pacified; and then, they related, that all their tribe but the chief and his sick son had fled on seeing the ship,—alleging as a reason that they feared the Investigator had come to revenge the death of a white man whom they had murdered some time ago. They proceeded to relate (through the medium of the interpreter on board the Investigator), that some white men had come thither in a boat, and that they built themselves a house and lived there. At last the natives murdered one; and the others escaped—they knew not where. The murdered man was, they said, buried in a spot which they pointed out. Capt. M'Clure adds, that he was prevented from examining this grave in consequence of a thick fog which obliged him to return to his ship. It is matter of most serious regret that the truth of this story was not inquired into. The history of the Adam Beck fabrication of the murder of white men by Esquimaux, and the well known habit of these latter to exaggerate and deceive, render it expedient, no doubt, to receive all accounts from them with much doubt:—but here the means of verification were apparently at hand. *Primâ facie*, it is hardly likely that natives would volunteer a statement to the officer so self-criminatory as the above, unless it rested on grounds of truth. And here we may mention, that a correspondent has drawn our attention to an extract of a letter seemingly bearing on the above story, which we published in our columns in 1848, (No. 1094, p. 1029,) and which excited considerable interest at the time. The letter in question was received by the Admiralty from Chief Factor Macpherson. It is dated March 1, 1848, and contains this passage:—"There is a report from Peel's River, that the Esquimaux saw two large boats (*query* ships?) to the east of the Mackenzie River full of white men; and they, the Esquimaux, showed knifes, files, &c., to the Peel's River Indians, which they had received from these white men. Could these have been Franklin or Rae?" To the latter query, we may at once answer, that it could not have been Rae; on the other hand, the locality referred to by the Esquimaux is precisely that in which a boat party endeavouring to return by the Mackenzie would have encamped. It agrees, too, exactly with the Esquimaux story told to Captain McClure; and we must hold, that steps should have been taken by him to investigate the matter. We trust, that the Hudson's Bay Company, who always evinced a desire to aid the searching cause, will lead a helping hand towards completing this inquiry.

Continuing his course to the east along the coast, the water being very shallow, but admitting of safe navigation, Cape Perry was reached by Captain McClure on the 6th of September.—From this position high land was observed to the E. N. E. This was taken possession of, and named Baring Island. Two days after this discovery, land was observed to the N. N. E., which was named Prince Albert Land. This is continuous with Wollaston and Victoria Lands, and extends north to 73 ° 21′ lat. and 112 ° 48′ west long. Here, Capt. McClure was very near Rae's discoveries in 1851. The Investigator was now navigated through a channel, called Prince of Wales Strait, dividing Baring Island from Prince Albert Land. This strait runs to the north-east, and was a most promising course for reaching the sea south of Melville Island. In the centre of the strait a number of islands were discovered,—to which the name of the Princess Royal was given; and a depot was made on one of them of three months' provisions for sixty-six men, with a boat and ammunition. Sailing up the strait, the Expedition progressed very favorably until the 11th of September,—when the ship was beset and drifted with the ice, narrowly escaping destruction several times, until the 8th of October. On that day she became firmly fixed. The position at this time, as will be seen by the accompanying chart, was not far from the northern extremity of the strait. Here she was frozen in,—and remained stationary during the winter.—Parties were sent out to explore; and it was soon ascertained that the channel opened into Barrow Strait. This established the existence of a North-West passage! Had the sea remained open a few days more, the Expedition would have made the passage,—not only in one season, but in the short space of little more than two months and a half.

The summer of 1851 was now anxiously awaited; but meanwhile advantage was taken of the spring to explore the coasts to the north-east and south-east in the direction of Bank's Land and Wollaston Land. In the course of their exploration, tribes of Esquimaux were met with who had evidently never seen white men before. They were quiet and inoffensive. Several musk oxen were shot on Prince Albert Land,—and proved a welcome addition to the supplies of the party.

On the 14th of July (1851) the ice opened without any pressure and the Investigator was again fairly afloat. Great exertions were made to pass through the strait; but, after many attempts, the progress of the Expedition was completely arrested on the 16th of August by strong north-east winds driving large masses of ice to the southward. At this date the party were in latitude 73 ° 32′ and longitude 115 ° 32′. Thus baffled, Capt. McClure boldly resolved on running to the southward of Baring Island, and sailing up northward along its western side. This, after many delays, and after surmounting formidable obstacles, he accomplished. Eventually he succeeded in reaching the north side of Baring Island on the 24th of September. Had open water existed to the east, the rest of the passage might have been easily performed this way; for Barrow's Strait lay before them,—the navigation of which from their position to Lancaster Sound was known to be practicable. Unhappily, however, on the night of the above day the Investigator was frozen up; and to the date of Capt. McClure's last despatch, (April 10, 1853,) she had not been liberated. Her position is 74 ° 6′ north lat. and 117 ° 54′ west long. Captain McClure describes the locality as being excellent:—well protected from ice by the projection of a reef which throws it clear of the ship 600 yards.

In April, (1852) a party crossed the ice to Melville Island—and deposited a document there giving an account of their proceedings and of the position of the Investigator. This was, happily discovered by Captain Kellett's officers—only a few days before Captain McClure had made arrangements for deserting his frozen-up ship. Immediate steps were taken to communicate with the party in their ice-prison!—and the excitement of the meeting between Lieut. Pim, who was appointed for the service by Captain Kellett, and the officers of the Investigator, they only will understand who can imagine the horrors of such a prison and the long, dreary and dreadful paths by which the prisoners were about to make their desperate attempt at escape from it.—It would, we hope, be precipitate to predict that the Investigator will not be liberated from her icy bonds this year; but we have high Arctic authority for stating, that, looking to the enormous quantity of ice this summer in Barrow's Strait, and in the seas south and west of Melville Island, it is not likely that the ship has yet been moved. The perils of Arctic navigation in the vicinity

of the pole receive a frightful expression in the following calm, gallant instruction given by Capt. McClure:—"It is my intention he says if possible, to return to England this season (1852) touching at Melville Island and Port Leopold; but should we not be again heard of, in all probability we shall have been carried into the polar pack, or to the westward of Melville Island,—in either of which events, to attempt to send succour would only be to increase the evil, as any ship that enters the Polar pack must be inevitably crushed. Therefore, a depot of provision or a ship at Winter Harbour is the best and only certainty for the safety of the surviving crew." This, as will be seen by the date, was written last year:—and precisely the steps recommended by him have been taken for the discovery and rescue of Capt. McClure and his companions.

With respect to the navigation of the North-west Passage, which is a subject of great geographical interest, Capt. McClure observes:—"a ship stands no chance of getting to the westward by entering the Polar sea—the water along shore being very narrow and wind contrary, and the pack impenetrable; but through the Prince of Wales Strait, and by keeping along the American coast, I conceive it practicable. Drift-wood is in great abundance upon the east coast of the Prince of Wales Strait, and on the American shore,—also much game. The hills in this vicinity abound in rein-deer and hares, which remain the entire winter:—we have procured upwards of 4,000 lb." From the observations which were made, it appears that the set of the currents is decidedly to the eastward.—"At one time," says Capt. McClure, "we found the set as much as two knots in a perfect calm,—and that the flood-tide sets from the westward, we have ascertained beyond a doubt, as the opportunities afforded during our detention along the western shore gave ample proof." This is one of the important facts of Capt. McClure's enterprise,—and established the propriety of making any future attempt at a passage which might be required from the side of Behring Straits.

Up to April 1852, the health of the crew of the Investigator was excellent; but during the past winter scurvy manifested itself—and it was fatal to three individuals in the spring.

According to the last accounts from Captain Kellett, it appears that he had sent his surgeon to report upon the health of the crew of the Investigator; and had given instructions that should there not be among them twenty men who were sufficiently well and would volunteer to remain another winter, Capt. McClure would desert his vessel. This step, indeed, seems to be contemplated; for Capt. Inglefield states, that the Intrepid steam tender was expected at Beechy Island with the crew,—and Sir E. Belcher had ordered the North Star to be prepared on her arrival to proceed to England and to leave the Intrepid at Beechy Island in her place.

We turn now to Sir E. Belcher's despatches:—which, if not so interesting in a geographical point of view as those of Captain McClure, yet contain many important features. At the head of these may be placed,—first, the existence of a polar sea, which Sir Edward feels convinced is now placed beyond a doubt:—and secondly, the discovery of what we would gladly hope may be further traces of Franklin.

When Capt. Inglefield left Beechy Island last year, he brought home the intelligence that Sir E. Belcher had gone up Wellington Channel, and had been absent three weeks. It now appears that he reached Cape Becher to the north-east, near which in lat. 76° 52′ and long. 97° West, a locality was found for winter quarters. Apprehensive that the open season was fast approaching to a close, preparations were made for boat and sledge explorations to the northward:—and these were commenced on the 23rd of August. On the 25th, when rounding a point where the coast suddenly turns to the eastward, the remains of several well built Esquimaux houses were discovered. "They were," says Sir E. Belcher, "not simply circles of small stones, but two lines of well laid wall in excavated ground, filled in between by about two feet of fine gravel, well paved, and withal, presenting the appearance of great care,—more, indeed, than I am willing to attribute to the rude inhabitants or migratory Esquimaux.—Bones of deer, wolves, seals, &c., numerous. Coal found." There is no mention of any search having been made for a record,—though in all probability this was not neglected; yet the absence of any cairn would seem to render it unlikely that a document existed. It will be observed that Sir E. Belcher does not hazard an opinion as to whether these huts were built by Franklin's party or not:—but if not by Esquimaux, it would be difficult to arrive at any other conclusion.

The explorations of Sir Edward and his officers led to the discovery of various lands,—to the most extensive of which the name of North Cornwall was given,—and of several islands washed by a sea open to the north, which, as we have stated, Sir E. Belcher regards as the Polar basin. Sir Edward gave the name of Victoria Archipelago to a group of islands in 78° 10′ N. lat.; and the easternmost, forming the channel to Jones's Strait, which communicates with the Polar Sea, he named "North Kent." It is important to add, that as early as the 20th of May he found the sea open in the latitude of Jones's Strait. His words are—"Polar sea as far as the eye could range." He also states that the tides were most apparent, setting from east to west.

Thus, it is due to Capt. Penny to record, tnat although many of his headlands and visual bearings are erroneous, as might be expected,—yet, the fine open water which he described as existing to the north of Wellington Channel is a reality, and his views of its connection with the Polar basin are borne out by Sir E. Belcher's observations.

In the spring of this year, a very extensive sledge journey was made by Commander Richards and Lieut. Osborne. They started from their winter quarters in Wellington Channel,—and bearing to the north-west in the first instance, afterwards struck south, and, crossing Melville Island, reached the winter quarters of the Resolute at Dealy Island. Here they communicated with Capt. Kellett:—from whom they heard the pleasing intelligence of the safety of the Investigator. By this exploration, which was extended over a period of ninety-seven days, the shores of the eastern side of the Hecla and Griper Gulf were examined; and returning up Byam Martin Channel, its connection with the Polar basin was ascertained.

The last despatches from Sir E. Belcher, dated "H.M.S. Assistance, on return to Beechy Island, about ten miles east of Cape Beecher, July 26, 1853," inform us, that his ships were liberated from the ice on the 14th of July,—and that his future proceedings will be determined by the nature of the despatches that he may find at Beechy Island. He strongly advocates the immediate return to England of the Investigator's crew; not conceiving it desirable that any further expense or risk should be incurred in waiting for the possible disruption of the ice. The probability of Capt. Collinson having followed Capt. M'Clure's track renders it expedient that a ship should be stationed at Melville Island,—and Capt. Kellett will in all probability be ordered to remain there.

Sir E. Belcher lays so much stress on the existence of an open Polar sea, that we are surprised that he does not state his intention of boldly entering it with his well-appointed ship and steam tender. Such a course would be warranted by his instructions, and at the same time be in harmony with his well-established spirit of enterprise.

It now only remains to notice Capt. Inglefield's despatches.

Having to tow the Breadalbane transport ship, his passage across Melville Bay was a difficult and tedious operation. Seldom during any part of the open season has so much ice been seen as was observed during this year. When in the middle of the bay, scarcely any water was visible from the mast-head,—and the Phœnix had already sustained so much damage from the pressure of the ice, as to render it necessary to shift the screw. On the 8th of August the Expedition arrived at Beechy Island; but so late was the season, that no water was seen from Cape Riley the day before. The ice was too abundant and hummocky to admit the possibility of landing the stores on Beechy Island;—and accordingly Cape Riley was selected for that purpose.

It became now an object of great importance to communicate with Sir E. Belcher,—and Capt. Inglefield resolved on being himself the bearer of Sir Edward's despatches. With this view, he started in his whale-boat, with a month's provisions, on the 10th of August,—leaving orders, in case of any unforeseen casualty preventing his return to the Phoenix by the time the transport was cleared, to run no risk of the ships being caught for the winter, but to proceed to England without him.

Wellington Channel was full of ice,—and so rough with large cracks and pools, that it defied sledging excepting with a strong party. An attempt was made to carry a small punt over the ice; but this proving ineffectual, Capt. Inglefield determined on proceeding by land with an officer and two men to Cape Rescue. Each man carried a blanket, a bag, and a fortnight's provisions. The Cape was reached, with much exertion, on the 13th of August; but further progress was arrested by open water. At this juncture, a notice was found stating that Capt. Pullen had returned to his ship after having communicated with Sir E. Belcher.

Having deposited duplicates of their despatches in the cairn, the party commenced their return to Beechy Island;—which was reached five days after their departure,—they having during this time travelled 120 miles. It was in a second attempt to convey the original despatches to Sir E. Belcher that one of the saddest episodes recorded in these last Arctic papers occurred. The gallant Lieut. Bellot, who, it will be remembered, accompanied Capt. Inglefield in the Phoenix—here lost his life. He had been sent by Capt. Pullen on the above duty:—having volunteered his services. A heavy gale having suddenly sprung up, he and two of his men were driven from the shore on a floe; and while reconnoitering from the top of a hummock of this floe in search of the means of escape for himself and his party, he was precipitated by a violent gust of wind into a deep crack in the ice, and there perished by drowning. Quite aware of his imminent danger, we are informed than in the face of death, he expressed his satisfaction that he was engaged in the performance of an important duty. His two companions were saved; and after driving about on the floe for thirty hours without food, they were enabled to regain their ship, bringing back the despatches in safety. Lieut. Bellot had won the friendship and esteem of all the officers on board the Phœnix. His loss will be deeply lamented here, —as doubtless it will be in the native service to which he was an honour. He had made a great number of magnetic and other observations, which will be placed in the hands of Col. Sabine for publication. He was at all times foremost in the offer of his services for any difficult or dangerous undertaking. Indeed, he sacrificed his life to a sense of duty. We are glad to learn that there is a design of erecting some testimonial commemorative of the loss of this excellent and able young officer. Such a step will, we feel sure, be duly appreciated by the French Government: —particularly if it should receive the countenance and support of our Admiralty. A meeting of the Royal Geographical Society will shortly be convened to take into consideration the best means of testifying the sympathy of the British public.

Shortly after Captain Inglefield's return to his ship, he had the misfortune to witness the total destruction of the Breadalbane transport. This event happened in the middle of the night of the 21st of August. The ice had been in motion for some days, —causing the greatest uneasiness respecting the safety of the vessels. At length a nip which the Phœnix resisted, proved too powerful for the less strongly constructed Breadalbane; and in less than fifteen minutes after she was struck she disappeared in thirty fathoms of water,—giving the people on board barely time to save themselves. Fortunately, nearly all the Government stores had been landed.—Another episode this, illustrating the terrible accidents of those seas which keep the dark secret of Sir John Franklin and his crews! The catastrophe shows, how important it is that ships should be efficiently strengthened for Arctic navigation. The voyage of the Investigator from Behring's Strait to her present position near Melville Island, is a proof how successfully a ship may be made to battle with thick-ribbed ice.

Captain Inglefield now resolved, in obedience to his instructions, on returning to England. With the crew of the lost Breadalbane in addition to his own, he left Beechy Island on the 24th of August; and after encountering many difficulties, he passed through Lancaster Sound, and into Baffin's Bay, rounding Cape Farewell on the 21st of September, and arriving off Thurso on the 4th of October.

It is worthy of mention that at Lievely, on the coast of Greenland, information was obtained of the existence of a coal mine twenty-six miles from the harbour, where coal may be obtained in large quantities. Captain Inglefield states that the Danes prefer it for burning in stoves to English coal.

Such are the principal and most interesting features of the despatches brought home by Captain Inglefield;—and under the head of geographical discovery, their importance cannot be overestimated.

It is of course quite possible that intelligence may yet arrive from Sir E. Belcher or Capt. Kellett, announcing either the discovery of our long-lost countrymen, or that of further tracks of their route and their possible whereabout. We have yet to learn the result of the explorations of Captain Kellett's officers; and we must not forget that Captain Collinson, who entered the ice at Behring's Strait in 1851, may by keeping a high north latitude strike their track. At the same time, although we have always leaned to the side of hope, bearing in mind the amazing quantity of animal life existing for the subsistence of the lost party in the Arctic regions, we cannot lose sight of the facts that the head waters of Wellington Channel have been partially explored without finding any vestige of Franklin or of his ships,—and that the explorations of Capt. M'Clure to the south-west of Melville Island prove beyond a doubt that they cannot be entangled in the ice in that locality. Our heart begins to faint, we must avow, beneath the burthen of hope deferred. Vast, however, as is the area which has now been swept by our searching ships, a much larger field yet remains unexamined. We cannot expect, after all that has been done, with the now faint chance of saving life if discovered, —that the Admiralty will continue the search until the ground shall be exhausted; but we would fain have the promising route by Nova Zembla tried, and the Siberian coast explored. Then, if the result of Sir E. Belcher's deliberations at Beechy Island shall be, his return to England, and consequent abandonment of the search for Franklin in the waters to the north of Wellington Channel, shall we be satisfied with the very imperfect search in that direction which still holds out the greatest promise? Surely, when we are told of an open sea in May, and of a Polar basin free from ice, its navigatian cannot be either difficult or tedious. Captain M'Clure has shown us that one north-west passage exists;

but we are much mistaken if other and more open passages far to the north, across the pole itself will not be found.

We may take this opportunity to state that one of the bottles picked up near the mouth of the Obi, on the Siberian coast, has lately arrived at the Admiralty. In a former number we stated that several of these bottles had been found in the above locality; and that the Admiralty had requested the Russian Government to forward one to England. It was, of course, hoped that it might prove to have belonged to Franklin's ships; but, having personally examined it,—we are sorry to say, that it is evidently of foreign manufacture, and not at all likely to have been furnished to Franklin's expedition. It is about the length of a soda water bottle—but more spherical; and is formed of very dark glass, nearly a quarter of an inch thick.

We are glad to hear that Commanders M'Clure and Inglefield have been promoted. To the latter we are indebted for a very clear chart showing Capt. M'Clure's track and discoveries;—from which the reduced map which accompanies this article has been copied.

The Daisy Anemone*.

All along this line of lime-stone rock, in almost every tide-pool and hollow that retains the sea-water, from the size of one's hand upward, we may at any time find colonies of the lovely Daisy Anemone, *Actinia bellis.* In the sunshine of a fair day they expand beautifully, and you may see them studding the face of the rock just beneath the surface, from the size of a shilling to that of a crown piece. Nothing seems easier than to secure them, but no sooner do the fingers touch them, than its beautifully circular disc begins to curl and pucker its margin, and to incase it in the form of a cup; if further annoyed, the rim of this cup contracts more and more, until it closes, and the animal becomes globose and much diminished, receding all the time from the assault, and retiring into the rock. Presently you discover that you can no longer touch it at all; it is shrunk to the bottom of its hole; the sharp irregular edges of which project and furnish a stony defence to the inhabitant. Nothing will do but the chisel, and that is by no means easy of appliance. It is rare that the position of the hole is such as to allow of both arms working with any ease; the rock is under water, and often, if your chisel is short, it is wholly immersed during the work, when every blow which the hammer strikes upon its head has to fall upon a stratum of water, which splashes forcibly into your eyes and over your clothes; the rock is very hard, and the chisel makes little impression; and what is frequently the greatest disappointment of all, the powdery *debris* produced by the bruising of the stone mingles with the water and presently makes it perfectly opaque, as if a quantity of powdered chalk had been mixed with it, so that you cannot see how to direct the blows, you cannot discern whether you have uncovered the *Actinia* or not, and frequently are obliged to give up the attempt when nearly accomplished, simply because you can neither see hole nor *Actinia*, and as to feeling in the pap-like mud that your implement has been making, it is out of the question. Supposing, however, that you have got on pretty well, that by making a current in the pool with your hand you have washed away the clouded water sufficiently to see the whereabouts, and that you perceive that another well-directed blow or two will split off the side of the cavity,—you have now to take care so to proportion the force that at last you may neither crush the animal with the chisel on the one hand, nor on the other drive it off so suddenly that it shall fall with the fragment to the bottom of the pool out of reach. However, we will suppose you have happily detached and secured your *Actinia* without injury. But how unlike its former self, when you were desirous of making its closer acquaintance, is it now! A little hard globose knob of flesh, not so big as a school-boy's marble, is the creature that just now expanded to the sun's rays a lovely disk of variegated hues, with a diameter greater than that of a Spanish dollar. It is moreover covered with tenacious white slime, which exudes from it faster than you can clear it away; and altogether its appearance is any thing but inviting. You throw it into a jar of water, which of course you have with you when collecting living zoophytes; and thus bring it home, when you transfer it to a tumbler or other suitable vessel of clear sea-water freshly drawn. And here let us watch its changes;—which, however, will not be effected immediately; for it will not expand itself in all its original beauty until it has taken a fresh attachment for its base, which will not in all probability be for a day or two at least. The body or stem of *Actinia bellis* is more or less cylindrical generally; though subject to some change in this respect, for it is occasionally a little enlarged, as it approaches the disk; the sucking base is slightly larger than the diameter of the body, which in specimens of an inch and a half expanse, may be about half an inch. The length of the body varies much, according to the depth of the cavity in which the animal lives, for it must expand its disk at the surface. In the open water in a vase, when it appears at home, it may commonly be about an inch from the base to the expansion of the disk, but I have a beautiful specimen before my eye at this moment, which has stretched itself to a height of three inches, expanding at the extremity as usual: the thickness of the stem is in this case somewhat diminished.

* Extract from a Naturalist's rambles on the Devonshire Coast.—By Philip Henry Gosse.

Extraordinary Fishes from California, constituting a New Family, described by L. Agassiz.*

About fifteen months ago, I received a letter fom A. C. Jackson, Esq., soon after his return from San Francisco, California, informing me that while fishing in San Salita Bay, he had caught with the hook and line, a fish of the perch family, *containing living young.* The statement seemed so extraordinary, that though an outline of the specimen observed was enclosed, I suspected some mistake, and requested Mr. Jackson to furnish me further information upon what he had actually seen, and if possible specimens of the fish preserved in alcohol. To this enquiry I received the following answer:

"I regret much that the information which I sent you avails so little, without the actual specimens of the fish and young; these, however, I have already taken active measures to obtain, and trust before many months, to be able to send you at least specimens of the female, if not of the young. I should at the time I caught the fish have preserved them in alcohol, but at that time I was attached to the Navy Yard commission, and was with my comrades industriously prosecuting the examination of the vicinity of San Salita, as to its adaptiveness for a navy yard, and could not leave for San Francisco without suspending the work, and the means for preserving the fish could not be otherwise procured. This explains the apparent culpable indifference which allowed me to omit preserving the specimens. I have sent directions to California to have caught for me several of the fish, and if at the present time, (September 16th, 1852,) the females were pregnant (which is not probable) to take from one the bag containing the young, and put mother and young into the jar of alcohol, and to put several other females untouched into the jar also. These specimens will by direction and examination, even if they be not pregnant, and if the jar contains no young, determine the truth and accuracy of the statement I made in my former letter on the subject. This fact, proved by these specimens, it will be

* Silliman's Journal, November.

very easy to obtain during the next spring and summer, specimens in all stages of pregnancy. I think, if I remain in the country, I can insure you a sufficiency of specimens to determine to your satisfaction, the true state of the affair, during the course of the next year. The fish I refer to, in my opinion, does not exist in very great numbers even in the waters of San Salita Bay, for the two which I caught on this occasion were the only ones which I fell in with, though I fished in the same place probably four times. There was a little peculiarity, perhaps, in the circumstance of my taking them as I did. I had previous to this time, tried my rod and line, as I mentioned before, four times, always with success as regards groupers, perch, &c., without a sight of the singular fish under consideration. A few days, perhaps a week, after the four trials, and on the 7th of June, I rose early in the morning, for the purpose of taking a mess of fish for breakfast, pulled to the usual place, baited with crabs, and commenced fishing, the wind blowing too strong for profitable angling; nevertheless, on the first and second casts, I fastened the two fishes, male and female, that I write about, and such were their liveliness and strength, that they endangered my slight trout rod. I however succeeded in bagging both, though in half an hour's subsequent work, I got not even a nibble from either this or any other species of fish. I determined to change the bait, to put upon my hook a portion of the fish already caught, and cut for that purpose into the largest of the two fish caught I intended to take a piece from the thin part of the belly when, what was my surprise to see coming from the opening thus made, a small live fish. This I at first supposed to be prey which this fish had swallowed, but on further opening the fish, I was vastly astonished to find next to the back of the fish, and slightly attached to it, a long very light violet bag, so clear and so transparent, that I could already distinguish through it the shape, colour and formation of a multitude of small fish (all fac-similies of each other) with which it was well filled. I took it on board (we were occupying a small vessel which we had purchased for surveying purposes,) when I opened the bag, I took therefrom *eighteen* more of the young fish, precisely like in size, shape, and color, the first I had accidentally extracted. The mother was very large round her centre, and of a very dark brown color, approaching about the back and on the fins a black colour, and a remarkably vigourous fish. The young which I took from her were in shape, save as to rotundity, perfect miniatures of their mother, formed like her, and of the same general proportions, except that the old one was (probably owing to her pregnancy) much broader and wider between the top of the dorsal and the ventral fins, in proportion to her length than the young were. As to colour, they were in all respects like the mother, though the shades were many degrees lighter. Indeed, they were in all respects like the mother and like each other, the same peculiar mouth, the same position and shape of the fins, and the same eyes and gills, and there cannot remain in the mind of any one who sees the fish in the same state that I did, a single doubt that these young were the offspring of the fish from whose body I took them, and that this species of fish gives birth to her young alive and perfectly formed, and adapted to seeking its own livelihood in the water. The number of young in the bag was nineteen, (I fear I mistated the number in my former letter,) and every one as brisk and lively and as much at home in a bucket of salt water, as if they had been for months accustomed to the water. The male fish that was caught was not quite as large as the female, either in length or circumference, and altogether a more slim fish. I think we may reasonably expect to receive the specimens by the first of December. But I can hardly hope to get satisfactory specimens of the fish as I found it with young well grown, before the return of the same season, viz., June. By that time I trust the facts will be fully decided, and the results, as important as they may be, fully appreciated."

In a subsequent letter (dated January 31, 1853,) Mr. Jackson informed me that he had requested Captain Case, U. S. N., who commanded a sloop of war in San Francisco, and who had also seen the fish, to supply my friend T. G. Cary, Jr., Esq., of San Francisco, with specimens of that fish, should he succeed in getting any. I wrote myself also to Mr. Cary, to be on the look out for this fish.

About a fortnight ago, I was informed by Mr. Cary, in a letter dated San Francisco, August 10, 1853, that after a search of several months he had at last succeeded in obtaining several specimens of this remarkable fish, three of which were sent by express, (which have reached me lately), while a larger supply was shipped round Cape Horn. After a careful examination of the specimens, I have satisfied myself of the complete accuracy of every statement contained in Mr. Jackson's letter of February, 1852, and I have since had the pleasure of ascertaining that there are two very distinct species of this remarkable type of fishes, among the specimens forwarded to me by Mr. Cary. I propose for them the generic name of Embiotoca, in allusion to its very peculiar mode of reproduction.

I feel some hesitation in assigning a family name to this type. It is probable that all its members will present the same peculiarity in their mode of reproduction, and that therefore the name *Embiotoca* may with perfect propriety be modified into *Embiotocoidæ*, as Didelphis has given its name to a numerous family, the *Didelphyidæ*, after having been for a long time simply a generic name. Should it however be found that other types of this family present various modifications in their vivaporous reproduction, for which the name *Embiotocoidæ* might be objectionable, I would propose to frame some family name from another structural peculiarity of these fishes, not yet observed in any others, the naked furrow-like space parallel to the base of the posterior dorsal fin, separating the scales which cover the base of the rays, from those of the sides of the body and name it *Holconoti*.

The perseverance and attention with which Messrs. Jackson and Cary have for a considerable length of time been watching every opportunity to obtain the necessary materials for a scientific examination of these wonderful fishes, has induced me to commemorate the service they have thus rendered to zoology by inscribing with their names the two species now in my hands, and which may be seen in my museum in Cambridge, labelled *Emb. Jacksoni* and *Emb. Caryi.*

A country which furnishes such novelties in our days, bids fair to enrich science with many other unexpected facts, and what is emphatically true of California, is in some measure equally true of all our waters. This ought to stimulate to renewed exertions not only our naturalists, but all the lovers of nature and of science in this country.

FAMILY HOLCONOTI OR EMBIOTOCOIDÆ.

The general appearance of the fishes upon which this family is founded, is that of our larger species of Pomotis, or rather that of the broader types of Sparoids. Their body is compressed, oval, covered with scales of medium size. The scales are cycloid, in which respect they differ widely from those fishes they resemble most in external appearance. The opercular pieces are without spines or serratures. Branchiostegal rays six. The mouth is encircled by rather thick lips; the intermaxillaries forming by themselves the whole margin of the upper jaw. The intermaxillaries and upper maxillaries are slightly protractile. Teeth only upon the intermaxillaries, lower maxillaries and pharyngeals; none either upon the palatines or the vomer. In this respect, as well as in the absence of spines and serratures upon the opercular pieces, they differ much more from the Percoids than from the Sparoids; but the cycloid scales remove them at once from the

latter, in which the scales present a very uniform ctenoid type. The thick lips might remind one of the Labroids, but the scales of the Embiotoca are neither elongated, nor provided with the characteristic branching tubes of that family.

One long dorsal fin, the anterior portion of which is supported by spinous rays, and the posterior by numerous articulated branching rays, which are sheathed at the base by two or three rows of scales, *separated from those of the body by a rather broad and deep scaleless furrow.* This last peculiarity has not yet been observed in any fish, as far as I know. There is indeed a distinct longitudinal space parallel to the soft portion of the dorsal, nearly of the width of a single row of scales, which is entirely naked and well defined, forming as it were, a furrow between the scales of the back, and those which rest against the base of the fin rays. Though protected in this way by a kind of sheath, the anterior part of the dorsal fin alone can be folded backwards and entirely concealed between these scales, as in many Sparoids; the posterior part only partially so. Moreover, the scales of the sheath are separated by a furrow from those of the back, only along the base of the soft part of the dorsal fin. The first rays of the anal fin are short, comparatively small and spinous. The base of this fin is strangely arched, and sheathed between scales, in the same manner as the dorsal; the spinous rays when folded back being more fully concealed in the sheath than the soft rays.

The ventrals are subthoracic as in the Sparoids, and provided with a strong spinous and five soft rays.

Four branchial arches, supporting four complete branchiæ with two rows of lamellæ in each. The opening behind the last arch is very small and entirely above the base of the pectoral fins. Pseudobranchia very large, and composed of sixteen or seventeen lamellæ. The alimentary canal is remarkably uniform in width for its whole length. It extends first on the left side as far back as the ventrals, turns forwards and upwards to the right, then follows the middle line along the *large air bladder*, to the second third of the abdominal cavity, then bends along the right side downward and slightly forwards almost to meet the first bend, when it turns backwards again, and ends in a straight course at the anus. The stomach can not at all be distinguished externally from the small intestine by its size and form. There are no *cœcal appendages at all* in any part of the intestine. The whole alimentary canal contained large numbers of shell fragments of small Mytili. The liver has two lobes, a short one on the left side, and a long one along the middle line of the body.

The female genital apparatus, in the state of pregnancy, consists of a large bag, the appearance of which in the living animal has been described by Mr. Jackson; upon the surface of it large vascular ramifications are seen, and it is subdivided internally into a number of distinct pouches, opening by wide slits into the lower part of the sack. This sack seems to be nothing but the widened lower end of the ovary, and the pouches within it to be formed by the folds of the ovary itself. In each of these pouches a young is wrapped up as in a sheet, and all are packed in the most economical manner as far as saving space is concerned, some having their head turned forwards, and others backwards. *This is therefore a normal ovarian gestation.* The external genital opening is situated behind the anus, upon the summit and in the centre of a conical protuberance formed by a powerful sphincter, kept in its place by two strong transverse muscles attached to the abdominal walls. The number of young contained in this sack seems to vary. Mr. Jackson counted nineteen; I have seen only eight or nine in the specimens sent by Mr. Cary, but since these were open when received, it is possible that some had been taken out. However, their size is most remarkable in proportion to the mother. In a specimen of Emb. Jacksoni, 10½ inches long, and 4½ high, the young were nearly three inches long and one inch high; and in an Emb. Caryi, eight inches long, and 3¼ high, the young were 2¾ inches long, and ⅞ths of an inch high. Judging from their size, I suspected for some time that the young could move in and out of this sack like young opossums, but on carefully examining the position of the young in the pouches, and also the contracted condition of the sphincter at the external orifice of the sexual organs, I remained satisfied that this could not be the case, and that the young Mr Jackson found so lively after putting them in a bucket of salt water, had then for the first time come into free contact with the element in which they were soon to live; but, at the same time, it can hardly be doubted that the water penetrates into the marsupial sack, since these young have fully developed gills. The size of the young compared with that of the mother is very remarkable, being full one-third its length in the one, and nearly so in the other species. Indeed these young Embiotocæ, not yet hatched, are three or four times larger than the young of a Pomotis (of the same size) a full year old. In this respect these fishes differ from all the other viviparous species known to us. There is another feature about them of considerable interest, that while the two adult differ markedly in coloration, the young have the same dress, light yellowish olive with deeper and brighter transverse bands, something like the young trouts and salmons in their Parr dress. The traversely banded species may therefore be considered as inferior to the other, since it preserves through life the system of coloration of the embryo.

It will be a matter of deep interest to trace the early stages of growth of these fishes, to examine the structure of the ovary and the eggs before fecundation takes place, etc., etc. The state of preservation of the specimens in my hands, precluded every such investigation.

Though I know thus far only one single genus of this type, I do not think it right to combine the generic characters with those of the family, as is generally done in such cases, as I would also object to the practice of omitting any specific characteristics where only one species is known of a genus. This shows an entire misapprehension of the relative value and subordination of the characters of animals. I would therefore characterize as follows the genus

EMBIOTOCA, AGASS.

Body much compressed and elevated. Head small, with scales only on the cheeks and opercular pieces. Teeth in both jaws, short, conical, arranged in one row, and slightly recurved. The pharyngeal teeth much shorter and blunter than those of the jaws, and arranged like pavement. Dorsal fin with nine or more spinous rays. The first three rays of the anal fin, spinous, and much shorter than the following articulated rays, which are always finer and more numerous than the corresponding rays of the dorsal fin. The lateral line is continuous to the base of the caudal fin. Whether the peculiar mode of reproduction is a family or a generic character, remains to be ascertained by further investigations. It is however probable that with some slight modifications it will be found the same in all the members of the family.

* Some differences between the two species observed, might render it doubtful whether they ought to be considered as belonging to as many distinct genera or not. But we know that in genera differing greatly from others, the range of the specific differences is also wider than in genera with many species; so until I am taught differently by new discoveries, I would refer them both to one and the same genus. Such doubts could scarcely be entertained respecting families with many genera, where a standard to estimate genuine generic differences is easily obtained.

1. EMBIOTOCA JACKSONI, AGASS.

The body is quite high, of an oval form, greatly compressed and similarly arched above and below. The superior arch extends to the posterior base of the dorsal fin, whence it continues in a horizontal line to the base of the tail. The ventral arch of the body is similar to that of the dorsal outline. The profile from the dorsal fin to the end of the snout, is rather precipitate and regularly arched, except obliquely above and in front of the eyes, where it is slightly concave. The greatest height of the body, including the dorsal fin, is equal so the distance from the end of the snout to the extremity of the pectoral. The head is of moderate size, its length, measuring to the posterior angle of the opercle, being about one-fourth that of the entire fish. The mouth is quite small, the hinder extremities of the intermaxillaries and maxillaries extending not further back than the line of the anterior border of the orbit. But a small portion of the superior maxillary is exposed at the angle of the mouth. The anterior edge of that part of the snout into which the intermaxillaries fit, is on a horizontal line drawn immediately below the orbits. The upper jaw is slightly more prominent than the lower, the teeth of the latter fitting *within* those of the former. In the upper jaw there are fourteen or fifteen teeth; in the lower there are two or three less. They are all slightly swollen near the top, and are not pointed, but rather bluntly edged. They do not extend to the angles of the mouth, but leave a space without teeth on each jaw. The teeth of the upper jaw are but little larger than those of the lower. The teeth of the pharyngeals are much shorter than those of the jaws, and form two quite moveable plates above, and a triangular one below. There are not more than thirty teeth on each of the superior plates, and mostly truncated at the top. The four or five teeth which form the inner row of each plate, are more prominent than the others, and somewhat pointed. The teeth of the inferior pharyngeal plate are similar to those of the upper, but the teeth of its posterior range are the most prominent and pointed. The lips are rather fleshy, and entirely conceal the teeth. Beneath the lower lip there is an elongated pit on each side, extending towards the corners of the mouth; it is covered by a thin border of the lip. The distance from the end of the snout to the anterior border of the orbit is greater than the diameter of the latter by one-third. The inferior margin of the orbit is on the middle longitudinal line of the body; and its posterior body is half way between the end of the snout, and the posterior angle of the opercle. The opercular pieces are large. On the preopercle are four concentric rows of scales; the two inner and anterior are the longer; there are thirteen large scales in the row nearest the eye, and the number is less and less in the others. Still within the row nearest the eye, there is a space without scales, and marked by pores radiating from the edge of the orbit. The posterior and inferior border of the preopercle, outside of the ridge of the latter, is thin, membranous, and without scales, but marked with numerous pores or tubes similar to those around the orbits, and radiating from within outwards.

The opercle, subopercle and interopercle are covered with scales, which decrease in size from the former to the latter. There is a narrow membranous border to the opercle, extending from its posterior angle to the height of the termination of the lateral line. The notch between the subopercle and the interopercle is on a vertical line with the edge of the posterior border of the preopercle. There is a small patch of scales, nine or ten in number, immediately above the superior attachment of the preopercle. The dorsal fin extends over about three-fifths of the superior curve of the body; its posterior portion is one-third higher, as well as longer, than its anterior. The spinous portion has nine or ten rays, the length of the first of which is equal to one third that of the last. At the point of each spine, the fin appears to extend backwards in a loose filament. There are 19½ articulated rays in the dorsal fin: the superior outline of this part is nearly similar to that of the back, although the rays of its first half are the longest, and nearly equal in length. The furrow on each side extends as far forwards as the base of the first articulated ray, where there are rows of scales forming the sheath; but the rows are reduced to one towards the posterior attachment of the fin.

The pectoral fins are of rather large size, and are placed below the middle line of the body, as well as below the posterior angle of the opercle. They extend about as near to the anal fin, as do the ventrals. The second ray of the pectoral is but slightly arched towards its extremity. There are twenty-one rays in each pectoral. The base of the ventrals is just in advance of the middle of this second ray of the pectoral. The spinous ray of the ventrals is three-fifths the length of the following articulated ray. There is a long plate of scales between the ventrals. The anal fin is broad and composed principally of fine slender rays. The last and longest of its spinous rays, equals in length one-fourth that of the following articulated ray, which latter is equal to the corresponding ray of the dorsal fin. The last ray of the anal fin is placed nearer the caudal fin than that of the dorsal. The fin itself at the base of the tail. The caudal fin is deeply forked; it contains fourteen rays, omitting its outer and short rays. There are eight rows of scales between the lateral line and the spinous portion of the dorsal fin, and eighteen rows below the lateral line in the same region. Sixty scales in the lateral line. Colour uniformly dark olive brown, along the back, fading slightly upon the sides; dorsal black, mottled with white; caudal blackish, lighter upon the base; and deep black, with a light longitudinal band; pectorals white; ventrals black with light base.

From the above description, it must be obvious that this is the species first observed by Mr. A. C. Jackson, to whom I have inscribed it, or at least a species very closely allied to it. There is only one fact about it which surprises me, that while he observed mature young in it on the 7th of June, Mr. T. G. Cary should have found it still with young as late as the beginning of August. Again Mr. Jackson saw nineteen young in it, whilst in the specimens forwarded by Mr. Cary, I found only eight or nine young, which were transversely banded like Emb. Caryi. May there be two species so closely allied as to be easily mistaken? I must add, that Mr. Jackson does not mention the mottled appearance of the dorsal, nor the light band upon the anal of his fish; which renders the supposition more probable that there are several and not only two species of this remarkable genus, about San Francisco. I would, however, not forego the opportunity of connecting the name of Mr. Jackson with his interesting discovery, and have therefore called *Emb. Jacksoni*, that one of the species sent me by Mr. Cary, which agrees most closely with his description, leaving it for the future to decide whether this species is truly the one he first saw, a circumstance which is quite immaterial, since we already know two species of this extraordinary type.

2. EMBIOTOCA CARYI. AGASS.

The body is much more elongated than in Embiotoca Jacksoni yet equally compressed. Its height including that of the dorsal fin, is less than the distance from the end of the snout to the extremity of the pectoral; and less than one-half the length of the fish. The profile is much less steep, and the snout quite as prominent, hence the head is longer than high. The posterior border of the orbit is nearer the angle of the opercle than the end of the snout. The upper and lower curves of the body are equal, and approach more nearly towards the tail, making this latter narrower than in the first species. The scales of the back do not descend upon the head lower than one-half the distance from the first spine of the dorsal to the end of the snout. The forehead is slightly concave as in Emb. Jacksoni. The posterior end of the

intermaxillary does not extend as far back as the anterior border of the orbit. The nature of the lips, and extent of the upper maxillary is much as in the other species, but the anterior edge of the socket of the intermaxillaries is *above* the line of the lower border of the orbit. A vertical line through the orbit shows the height of the head in this region to be one-third less than in E. Jacksoni. The opening of the mouth is directed more obliquely upwards. The teeth are more slender, but have otherwise the same form. In the upper jaw there are twelve, in the lower eight teeth. The nasal openings are of tolerable size; one before the other, and in advance of the eye, but slightly below the line of its superior border. The vertical diameter of the orbit is less than its longitudinal; and its posterior border is nearer the angle of the opercle than the snout. The preopercle in this species is less rectangular than in the former. The inferior rounded angle of its *ridge* is in *advance* of the posterior margin of the orbit. The scales of the preopercle are also much smaller and less conspicuous. Tubes radiate from the border of the orbit and from the ridge of the preopercle, as in Emb. Jacksoni. The posterior membranous border of the opercle is narrower: the notch between the subopercle and interopercle is on the vertical line of the posterior border of the preopercle. There is a patch of scales above the superior attachment of the preopercle. The dorsal fin differs very little in form from that of the former, but extends somewhat farther forwards, its first spine being immediately over the posterior angle of the opercle. The distance from this spine to the end of the snout equals the distance from the same back to the ninth articulated ray. The posterior rays of the articulated portion are shorter than in the first species, but they are more numerous by three rays. The pectoral has twenty-one rays; it is perhaps longer than in the other. The ventrals differ little. The anal fin however, differs greatly: it is very small and contracted, and is placed far behind the ventrals. The scales at its base form a waved outline much more marked than in E. Jacksoni. The spinous rays are very short, the last being less than one-half the length of the following articulated ray, the base of which latter is directly under that of the fifteenth corresponding ray of the dorsal fin. Its posterior base and termination are as in the first species. The caudal fin however, is more slender, and more deeply notched. The scales of the body are by no means so large. The lateral line, follows the outline of the back, as in E. Jacksoni; there are seventy-five scales in it.

Color light olive, darker along the back; light brown longitudinal bands extend between the rows of scales, and darker transverse bands reach from the back to the sides of the body, not extending below the lateral line in the anterior part of the trunk, but more marked, and reaching nearly to the anal fin upon the tail. Head mottled black and white. Dorsal and caudal dotted with black and white. Anal with a large diffuse black mark upon lighter ground. Pectorals white. Ventrals white at the base, terminated with black.

Only one female has been observed, containing eight young. This species was discovered by T. G. Cary, Esq., in the Bay of San Francisco, in the beginning of August, 1853.

Directions for Collecting Fishes.—By Louis Agassiz.

The present condition of our science requires collections made in a very different spirit from those gathered in former years. The naturalist must not only know all the different kinds of animals; he must also become acquainted with the changes they undergo while growing, and with their geographical range. To arrive at this knowledge, it is necessary to obtain, separately, complete collections from every district upon the mainland, from every inlet along the sea-shores, and from every distinct fresh water basin, and to select a number of specimens of every kind, if possible so as to include the young as well as the adults, males and females.* The number and diversity of species found in our fresh waters especially, is much greater than is usually supposed by accidental observers. A variety of little fishes, sometimes belonging even to different families, are almost everywhere used for bait by fishermen, and frequently mistaken under one common name, minnows, are supposed to be simply the young of larger kinds. Among these, most valuable discoveries may be made. There are still districts in our country where a naturalist may fish half a dozen new species and more of these small nondescripts, in a single creek, within a few hours.† A small handnet is very useful to collect these smallest kinds of fishes, and I have generally found that I could more easily obtain this small fry from boys, than from either fishermen or anglers. Again, scores of fishes are indiscriminately called bass, perch, sunfish, suckers, &c., in different parts of the country, which, when compared side by side, prove as different from one another as a robin and a crow. It is, therefore, a matter of great importance for the naturalist to net every species of fish from every water basin, that he may have an opportunity of ascertaining for himself how far they agree, and how far they differ, in different watercourses. Anglers and professional fishermen generally know the fishes of their own fishing grounds much better than naturalists, and from them most valuable information may be obtained respecting the species inhabiting their neighbourhood. There is, on that account, no difficulty in ascertaining from them whether a complete collection of all the fishes of any given locality has been obtained. But the difficulty begins when it is attempted to identify the fishes of different places, relying upon their names for comparison. Such is the confusion of these names in different sections of the country arising from the use of the same names for different objects, and of different names for the same objects, that nothing short of complete collections obtained *separately* from every important locality will prevent the naturalist from making gross mistakes in his identification of species from remote localities. Few men not trained in the study of natural history are prepared to believe that even the fishes living in the head waters of a river may differ entirely from those living in its middle and lower course, and that it may therefore be necessary to make separate collections in different parts of one and the same water-basin. This is still more important respecting distinct water-systems, But a complete survey ought to cover the whole ground as soon as possible It would not be too much to have one collection for every hundred miles upon our large streams, and one for every fifty and even for every twenty miles upon smaller rivers.

The preservation of fishes requires but little care and attention. Any vessel, jar, can, keg, or barrel fit to hold alcohol, is also fit for collecting fishes, which may be heaped upon it like herrings in salt. The alcohol used must be of about the strength of that that of .88 specific gravity‡ for most fishes; for suckers and brook-trouts, however, it ought to be stronger, about .80, their flesh being either soft or fat, and more readily decomposed. In *summer or in warm climates* it is advisable to use always strong alcohol to obviate the effects of evaporation. Suppose it is intended to make a complete collection from one of the larger tributaries of some of our great rivers. All that is wanted will be a

* There are many species of our fishes in which the sexes differ as much as among our fowls.

† It actually happened to me last winter, at Mobile, Ala., and at St. Louis, Mo., to discover six and even eight new species of fishes in a single day.

‡ Common whiskey of .90 to .92 specific gravity may be used by adding strong alcohol, in the proportion of one gallon of alcohol to one gallon of whisky. Highly rectified whisky as it is prepared in some parts of the country, may occasionally do by itself, especially if it has nearly the specific gravity of .88. It is, however, always safer to err by using too strong than too weak spirits. Specimens may be contracted by too strong alcohol, and lose to some extent their form; they will certainly spoil entirely in too weak a mixture.

few jars, such as are used to keep preserves, a barrel of about fifteen or twenty gallons, and a supply of whisky and alcohol. These may be kept in a cool place, a cellar, or a sheltered recess, ready to receive the fishes. The smallest fishes are best kept by themselves in jars, and the larger ones in a barrel. The barrel ought to be put upon one head, the other removed and used as a cover. It will be well to see that the fishes are placed in it in as natural a position as possible, that is to say, stretched out with the fins closed against the body, or at least not unnaturally bent. It is equally desirable to exclude specimens the fins of which are bruised, and the scales rubbed off, unless they be rare species. When the fishes are too big to be stretched across the barrel, they may be gently bent upon the flatter side, and if too stiff to allow this, put in, head foremost, in an upright or slanting position, and then slightly bent against the sides of the barrel. It is useless at first to pour more alcohol over the fishes than is necessary to cover them. While cruizing at sea, it will be well to throw some rags over the specimens to prevent their jarring, until the vessel in which they are contained is quite full and headed up. Of the smaller kinds of fishes, at least a dozen of each would be required for a full and satisfactory examination. Where they may easily be caught, more would be very acceptable. Of those of medium size, about half that number; and of the larger ones, as may be most convenient, one, two, or three. It will secure a better state of preservation, and afford fuller means of study if a cut is made into the belly of the larger fishes, to allow the alcohol to penetrate into the intestines. At all events, these ought never to be removed. The knowledge of the local names is very desirable. To rectify the errors of nomenclature now spread over the whole country, the simplest way of recording the name of a fish is to write it with a black, hard pencil upon a piece of stiff paper, or with indelible ink upon cloth, and to place such paper under the gill-cover of the specimen to which it belongs. Specimens too small to be labelled in that way may be rolled up in a piece of cotton cloth upon which the name is written. Delicate fishes, with very deciduous scales, would keep better if they were wrapped up singly in this way in cloth. Any other notices respecting the habits, uses, &c., of such specimens may be preserved in the same manner, or referred to a No. inscribed upon the label of the fish. It would be very important to record as far as possible the date at which the specimens preserved were caught. This may often enable the anatomist to determine the spawning season of the species. Also, the depth at which they are known to live. Should any collector be sufficiently familiar with painting to draw coloured figures of any of these fishes, or so situated as to have some of them drawn by an artist, it would be an invaluable contribution to Natural History.

When collections have to travel over great distances, or to be for many months on a journey, it is desirable that every specimen should be wrapped up singly in a piece of cloth; but this is not necessary, generally speaking, for collections which are likely to be taken care of after a short journey.

Those unaccustomed to making collections may occasionally suppose from their smell that they are spoiling, the mixture of alcohol with dead animal matter being rather disagreeable; but unles there is actual putrefaction, no apprehension need be had respecting the safety of a collection, and the removal of decayed specimens is all that is required for the preservation of the remainder, provided the alcohol has the necessary strength of at least twenty-eight degrees of Beaumé, or .88 specific gravity. To avoid losses, it is prudent never to use kegs of more than twenty to twenty-five gallons, save in exceptional cases, where very large and highly valuable specimens are to be preserved. As a general rule a twenty-five gallon keg will contain any desirable specimen collected even in our largest rivers, there being always an opportunity now and then to obtain a moderately large specimen of our largest fishes, which when full grown are at any rate too bulky to be preserved in alcohol. Upon small watercourses, or small ponds, an ordinary jar may be sufficient to contain complete separate collections of their natural productions. Of very large fishes, especially of sharks and skates, the skin may be preserved, leaving the whole head attached to it, and rolled up, preserved like other specimens in alcohol. A longitudinal cut upon one side, in preference the right side, will afford sufficient facility for removing the intestines and all the flesh and bones of the body. Skeletons would be also very desirable. To obtain them it is simply necessary to boil the animal, either whole or in part, and to gather and clean all the bones, and preserve them together in a sack. A naturalist will readily put up the loose parts in their natural connexion.

Extracts from the First Report of the Secretary of the Board of Registration and Statistics on the Census of the Canadas for 1851—52.

The returns of a population Census acquire their chief utility from being contrasted with those of former periods, as from this comparison we learn the increase or decrease of the population, the annual rate of such variations and the proportionate relation of the two sexes. From these results as it has been said, "we approximate to something like a Law of Population, or to certain natural rules, the infraction of which must be due to particular and perhaps removable disturbing causes." It has been found that although the population of Great Britain has increased upwards of ten millions during the last half century, yet throughout this period, the sexes have presented their relative proportion, viz: 30 males to 31 females.

Until the Abstracts of the personal census are completed, it will be impossible to do justice to this most interesting feature of the census. A few general remarks must at the present time suffice, and our chief attention be directed to the agricultural produce and prospects of the country.

It is believed that a very general feeling prevails, not only in the Mother Country but even in Canada, that her growth and prosperity are not commensurate with that of the United States, and without any inclination to deny or conceal the rapid progress of our neighbours, it may be well by a few facts, compiled from statistical returns, to prove how erroneous such an impression is—the growth of Upper Canada, taking it from the year 1800, having been nearly *thrice* that of the United States.

According to the "World's Progress," a work published by Putnam, of New York, in 1851, page 481—the free population of the United States was in 1800, 5,305,925; in 1850, it was 20,250,090, (in 1810 it was 7,239,814,) thus in 50 years its increase was not quite 400 per cent., whilst that of Upper Canada was upwards of 1100 per cent, for the 40 years from 1811 to 1851.

Comparing the last decade of Upper Canada with that of other countries, exclusive of Australia and California, we arrive at the following result:

The total number of inhabitants in the United States, on the 1st June, 1850, according to the census report, was 23,263,488, but it has been shown that the probable amount of population acquired by territorial additions should be deducted in making a comparison between the last and former census. These diminish the total population of the country as a basis of comparison to 23,091,488.

United States—Census of	1850..	23,091,488
"	1840..	17,067,453
Increase in 10 years..		6,022,035 or 35,27 per cent.

Great Britain—Census of	1851..	21,121,967	
"	1841..	18,658,372	
Increase in 10	years..	2,463,595	or 13,20 per cent.
Ireland—Census of	1841..	8,175,124	
"	1852..	6,515,794	
Decrease in 10	years..	1,659,330	or 20 per cent.
Upper Canada—Census of	1851..	952,004	
"	1841..	465,357	
Increase in 10	years..	486,647	or 104,58 per cent.

The first census of Great Britain was taken in 1801, at which date the population amounted to 10,567,893, and thus it has doubled itself in half a century, an increase nearly equalling that in all preceding ages. It is supposed that in the eleven centuries which elapsed between the landing of Julius Cæsar and William the Conqueror, the population hardly doubled itself; thus, that which in former times it required eleven centuries to accomplish in England, has been done in Upper Canada in 10 years. The census returns of all countries prove how much faster population increases in modern than in ancient times. In the last 10 years 5,308,181 have been added to the population of Great Britain, which exceeds the known increase of the last 50 years of the last century.

Whilst the population of almost all other countries is increasing that of Ireland is, from various causes, 286,033 less than it was in 1851; the greatest decrease has been in the county of Cork, where, in 10 years, the population has been reduced from 773,398 to 551,152.

It may be argued that it is not fair to take the whole of the United States for a comparison with Upper Canada, much of that country being comparatively old and long-settled. It will be seen from the United States census, that the three States of Ohio Michigan and Illinois contained in 1830, 1,126,851. In 1850 they contained 3,505,000, a little over 320 per cent. in 20 years.

Canada West contained in 1830, 210,437; in 1849, it contained 791,000, which is over 375 per cent. for the same period of 20 years—so that the increase in these three choice States was 55 per cent. less than that of Canada West during the same time. The Western States attract an enormous population and at this time settlers are crowding into Iowa, and peopling the banks of the Missouri.

The statistics of Canada prove the same feeling to exist here as in the United States. The Gore and Wellington Districts have increased 1900 per cent. in 33 years up to 1850. The Western District has increased over 700 per cent.; the London District, 550 per cent.; the County of Norfolk, 550 per cent.; the County of Niagara about 380 per cent.; while in eight years the County of Oxford has doubled its population.

And in the far West of Canada the Counties of Huron, Perth and Bruce, have increased from 5,600 in 1841, to 37,580 in 1851, being upwards of 571 per cent. in 10 years, an increase almost beyond comprehension. It appears from Smith's work on Canada, that the Huron District has made more rapid progress since its first settlement in 1827, than the States of Ohio, Michigan and Illinois did in double that time, or than Lower Canada did in 104 years ; the latter is doubtless owing to the almost entire absorption by Western Canada of the vast immigration from Europe.

This immense increase is not however confined to the rural districts, for the cities and towns will equally vie with those of the United States, and a few extracts from the Rev. Mr. Lillie's excellent lectures on the growth and prospects of Canada, afford an interesting proof of this fact.

The population of Boston was,

In 1790	18,038
1810	33,250
1820	43,299
1830	61,391
1840	93,000
1840	135,000

"Dividing the above into two periods of 30 years each. Boston contained at the close of the first about $2\frac{1}{2}$ times its number of inhabitants at the commencement, while the close of the second shows $3\frac{1}{10}$ times the number of the beginning, the population of 1850 is eight times (or nearly) that of 1790. Toronto being in the former of these years over six times what it was 18 years before (in 1832,) and more than 75 times what it was 49 years before (in 1801.) Between 1840 and 1850, the increase was on Boston 45 per cent.; on Toronto 95 per cent."

"New York, the emporium of the New World and a city which for its age may vie with any in the world, numbered—

In 1790	33,131
1810	96,373
1830	202,548
1840	312,710
1850	517,000

Its increase thus stands as compared with Toronto—$2\frac{1}{2}$ times in the 20 years from 1830 to 1850, against 6 times in the 18 years between 1832 and 1850,—16 times in 60 years against 75 times in 49 years—66 per cent. between 1840 and 1850, against 95 per cent.

"St. Louis, which had in 1850, 70,000 inhabitants had increased it 15 times that in 1820. Toronto had in 1850 increased hers 18 times that in 1817."

"The population in Cincinnati was in 1850, 115,590, or 12 times its amount in 1820, 30 years before; and Toronto had in 1850, 18 times its population in 1817, or 33 years before."

Hamilton had in 1836 a population of 2,846 and now by the last census 14,112.

Dundas has in 6 years increased from 1,700 to 3,517.

The increase in Brantford during the last 10 years has been nearly 300 per cent. and during the year 1850–51, rose from 3,200 to 4,000, or 25 per cent. Belleville, in the same period has increased from 3,500 to 4,569. London, from 5,124 to 7,035.

Galt has increased in five years from 1,000 to 2,248, and Guelph in 7 years from 700 to 1,860.

Woodstock has increased in 1850–51, from 1,200 to 2,112, and Ingersoll has increased in 4 years from 500 to 1,190.

Kingston, in 10 years,	from	6,292	to	11,585
Toronto, "	"	14,249	to	30,775

Lower Canada, though not advancing in the same ratio, presents some few instances of an enormous increase in her population. Among these we may instance—

The County of Megantic, which in 7 years, from 1844 to 1851 increased from 6,449 to 13,835, or at the rate of 115,40 per cent.

The County of Ottawa, which in the same time has increased from 12,434 to 22,903, or 84.42 per cent.

The County of Drummond, from 9,354 to 16,562, or 77.28 per cent., and

The County of Sherbrooke, from 13,485 to 20,014, or 49.47 per cent.

The following table, which may be interesting for the purpose of reference, is compiled from Weber's Almanac for 1853, published at Leipsic, and gives the population of the largest cities of Europe and North America. As the Germans are proverbially accurate in their statistical statements, it is believed that it may be relied upon as correct.

1. London	2,363,141	34. Pesth	125,000
2. Paris	1,053,262	35. Prague	124,181
3. Constantinople	786,990	36. Barcelona	120,000
4. New York	522,766	37. Genoa	120,000
5. St. Petersburg	478,437	38. Cincinnati	116,710
6. Vienna	477,846	39. New Orleans	116,348
7. Berlin	441,931	40. Bristol	115,000
8. Naples	416,476	41. Ghent	112,410
9. Philadelphia	409,354	42. Munich	106,770
10. Liverpool	384,263	43. Breslau	104,000
11. Glasgow	367,800	44. Florence	102,154
12. Moscow	350,000	45. Rouen	100,265
13. Manchester	296,000	46. Belfast	98,660
14. Madrid	260,000	47. Cologne	92,244
15. Dublin	254,000	48. Dresden	91,277
16. Lyons	249,325	49. Stockholm	90,823
17. Lisbon	241,500	50. Rotterdam	90,000
18. Amsterdam	222,800	51. Antwerp	88,800
19. Havana	200,000	52. Cork	86,485
20. Marseilles	195,257	54. Liège	77,587
21. Baltimore	189,054	54. Bologna	75,100
22. Palermo	180,000	55. Leghorn	74,530
23. Rome	172,382	56. Trieste	70,846
24. Warsaw	162,597	57. Konigsberg	70,198
25. Leeds	152,000	58. Sheffield	68,260
26. Milan	151,438	59. The Hague	66,000
27. Hamburg	148,754	60. Leipsic	65,370
28. Boston	136,788	61. Oporto	62,000
29. Brussels	136,208	62. Malaga	60,000
30. Turin	135,000	63. Dantzic	58,012
31. Copenhagen	133,000	64. Francfort	57,550
32. Bordeaux	130,927	65. Magdeburg	56,629
33. Venice	126,768	66. Bremen	53,166

The following is the rate of increase in the Population of Upper Canada from the year 1811.

In 1811 the population was 77,000 according to Bouchette.

1824	ditto	151,097	rate of inc.	7.40	p. ct. p. an.
1825	ditto	158,027	ditto	4.59	ditto
1826	ditto	163,703	ditto	3.60	ditto
1827	ditto	176,059	ditto	7.54	ditto
1828	ditto	185,526	ditto	5.37	ditto
1832	ditto	261,060	ditto	10.18	ditto
1834	ditto	320,697	ditto	11.42	ditto
1835	ditto	336,469	ditto	4.91	ditto
1838	ditto	385,824	ditto	4.88	ditto
1839	ditto	407,515	ditto	5.62	ditto

In 1840 the population was		427,441	rate of inc.	4.88	p. ct. p. an.
1841	ditto	465,357	ditto	8.77	ditto
1842	ditto	486,055	ditto	4.45	ditto
1848	ditto	723,332	ditto	7.7	ditto
1851	ditto	952,004	ditto	10.54	ditto

AGRICULTURAL PRODUCTIONS:

	Brls.	Bush.
Total Export of Wheat in 1851,		933,756
Total Export of Flour in 1851,	668,623	
	or	3,343,115
Total Home consumption, allowing 5 bushels for each inhabitant, in a population of 1,842,265,		9,211,324
Total Seed at 1½ Bushels per acre :		
Upper Canada,	780,385	
Lower Canada,	335,926	
	1,116,311	
At 1½ Bushels per acre		1,674,466
Total number of Bushels of Wheat on these calculations,		15,162,662
Total returned by Census :	Bush.	
Upper Province,	12,802,272	
Lower Province, about	3,400,000	
		16,202,272
Total growth of Wheat in all Canada, calculating the Flour at 5 Bushels per Barrel—the consumption at 5 Bushels per head—and the Seed at 1½ Bushels per acre,		15,162,662
		1,039,610

Leaving 1,039,610 Bushels to be accounted for in some other way.

The Home consumption is probably very nearly five and a half Bushels for each individual; the seed required in 1853 would be for the increased number of acres under Wheat in 1854.

In the United States the Home consumption is calculated at six bushels per head,—but there appears to be no ground for such a calculation, especially as so much Indian Corn is used for food—and in fact the whole growth of Wheat in 1850, as given on page fifty-seven of the Abstract of the last Census of the United States, divided into the population of the same year, gives only $4\frac{16}{60}$ bushels for each inhabitant, whilst the Returns of the Canada Census give more than double that amount, viz : $8\frac{46}{60}$ bushels.

It is true that the quantity of Indian Corn per individual is much larger in the United States than in Canada, but it is well worth observing, that, deducting the Exports of that year, amounting to about 12½ millions of bushels, (allowing five bushels to the barrel of Flour,) as appears in page fifty-seven of the Abstract of their last Census,—and allowing 12½ millions for seed at 1½ bushels per acre, their individual consumption of Wheat is little more than three bushels per head—whilst that of Canada is 5½—this may be accounted for by the increased consumption of Rice as well as Indian Corn.

In the United States the growth of Wheat has increased about forty-eight per cent. during the last ten years, whilst in Canada, during the same period, it has increased upwards of 400 per cent! ! And taking the article of Indian Corn, which is the production that compares most favorably for the United States, the increase on it for the ten years between 1840 and 1850, has been equal to 56 per cent. viz: from 377½ millions of bushels to 592⅛ millions,—(see page 60 of Mr. Kennedy's Report,)—whilst the increase in Canada for the last nine years has been 163 per cent., the Census having been taken in 1842 and not in 1841. During the same period also, the increase in the growth of Oats

in the United States has been 17 per cent., whilst in Upper Canada it has been 133 per cent.,—in Lower Canada, 41 per cent., —and in both united 70 per cent.

In Peas we find the increase in Upper Canada has been 140. per cent., in nine years—that of the United States, or any of them, is not given in the Abstract of the Census; but, with them, it appears to be an article of little importance, the whole crop of all the States and Territories, being only a few bushels over the produce of Canada.

In comparing the different columns of the foregoing tables, some not uninteresting inferences and deductions may be drawn.

It will be perceived that though the number of cultivated acres in Ohio is one-fourth greater than those of Canada, being 9,800,000 to 7,300,000, or rather more than ten to seven, yet the bushels of Wheat are one-twelfth less, being in Ohio 14,487,000 to 16,202,272.

Ohio, in cultivated acres, possesses $\frac{1}{12}$ of all the United States In uncultivated acres, possesses $\frac{1}{22}$ of the same.

She possesses one-fourth more cultivated land per inhabitant than Canada, having five acres to four.

All Canada produces one-seventh more bushels of Wheat than Ohio, and $1\frac{1}{2}$ bushels more per individual. Upper Canada, however, produces six bushels more Wheat per individual than Ohio—the latter producing in her staple Indian Corn twenty-nine times more than Canada, which produces 77 times more Peas, and 54 per cent. more Oats than Ohio. The land of Ohio is valued at nearly double that of the average of the Union,—(see the Report of Mr. Kennedy, page 46,)—and has more than three times as many inhabitants to the square mile as the Average of the Union—she having $49\frac{55}{100}$ and the average of the States being $15\frac{75}{100}$.

The produce of Wheat per acre in Upper Canada is $16\frac{14}{80}$ and Lower Canada $7\frac{8}{80}$ bushels per acre. The Census Superintendent in the States has followed in the footsteps of the English Superintendent in not giving an account of the number of acres under any particular description of crop, and thus we can form no just opinion of acreable produce. This is much to be regretted as the more we particularize comparisons, not only of County with County, or State with State, but Townships with Townships, Fields with Fields, and Acres, with Acres, the more easy shall we find it to draw useful deductions to account for success here, or failure there, and to ascertain whether it be climate, or soil, or management, or skill, or the absence of them, or defect in them, that gives one locality an advantage over another.

To give an example of this, it is only necessary to see the vast difference which exists in the amount and value of different productions in different parts of the same country.

In the article of Wheat, we find that the whole United States produced in 1850, only 100,479,000 bushels, whilst the one State of Ohio,—one out of 32 and 4 large territories—produced more than one-seventh of the whole Union.

Again, Ohio produced $7\frac{1}{2}$ bushels for each inhabitant, whilst the whole of the United States produced only $4\frac{1}{3}$—the former having one-eighth of her cultivated land under wheat, whilst the whole Union has not one-twentieth of the cultivated land under that crop.

With perhaps equal advantages, we find an enormous discrepancy in some of our own wheat-growing districts. In the year 1850, the Township of Esquesing in the County of Halton, produced 26 bushels of wheat to the acre, and that of Adolphustown, in the County of Lenox, only 6 bushels to the acre, and this with soil and climate perhaps equally good. This is at once accounted for by the ravages of that fearful plague to the farmer the weevil. The worst wheat crops in Canada West, in the year 1851, were in those counties where the weevil was prevalent. It committed the most serious depredations, in very many cases rendering whole fields of most promising wheat not worth the threshing. This fly, which deposits its larvæ in the blossom of the wheat, in order to feed upon the milk of the grain as it ripens, was unfortunately in that year the most abundant in the Counties of Frontenac, Lenox, Addington, Hastings, and Prince Edward, and is travelling gradually west at the rate of about nine miles every summer, and remains from five to seven years in a locality. The only prevention yet discovered has been to sow early seed on early land, and very early in the autumn, so that the wheat may blossom before the enemy takes wing, the period for which depends much upon the earliness of the season. So destructive was the fly in 1851, that the fine agricultural county of Lennox produced only 6 bushels per acre, Hastings about 10, and Prince Edward, Addington and Frontenac, about 11. It had not in that year reached the County of Northumberland, but was very destructive in that county the following year, 1852.

Canada possessed, in 1851, 46,939 more milch cows than Ohio, and yet Ohio produces $\frac{1}{8}$ more butter, and nearly eight times as much cheese as Canada.

This is a most important feature in the difference between the two countries — amounting annually to the large sum of £276,122 for butter, and £376,703 for cheese, in favour of Ohio, although Canada possesses nearly 47,000 more cows. How to account for so great a difference, the prices being taken at the same rate in both countries, is a very difficult matter. The having a more congenial climate than Canada East, shorter winter, and the supply of green food continuing for a larger period, may account for a great deal, but certainly not for such a serious discrepancy. The natural inference is that the breed of cows in Canada must be very inferior to those of Ohio.

It may, however, fairly be observed that Ohio exceeds the average of the whole United States, in the amount of butter per cow, 27 per cent., and in the amount of cheese, 133 per cent.; Upper Canada exceeds the average of the whole Union by about 9 per cent. in butter, but is very deficient in cheese. The difference in the value of the yield of one cow in Upper Canada and Ohio, calculating the price of butter at $7\frac{1}{2}$d. per lb. and cheese at 5d., in both places, would be 16s. $10\frac{1}{2}$d. in favour of Ohio, and the extra milk and whey would make 20s., supposing the returns to be correct, which there is no good reason for doubting. As a proof, however, if proof were necessary, that the climate of Ohio is much less severe than that of Canada, it may be stated that although she has one-third more horses, viz: 78,020—about 63,000 more young cattle, and $2\frac{1}{4}$ millions more sheep, she produces less hay by 204,203 tons, and very much less straw and other fodder, even allowing that she has 29 times more corn stalks.

The increase in the production of the articles of butter and cheese in Canada, has notwithstanding been enormous, and we find that within the three years, 1849, 1850, and 1851, the amount of butter produced has, in the Upper Province, increased 372 per cent., and that of cheese during the same period, 233 per cent., which leads to the inference, that our milch cows are rapidly improving in quality. The census returns of the Lower Province, previous to the year 1851, are very deficient as to the amount of these articles.

The next most important feature in the difference between Ohio and Canada is in the number of their sheep, and the consequent

value of their wool. Here, too, the difference is difficult to be accounted for, but the fact should open the eyes of the Canadian farmers to their interest.

The number of sheep in Canada, in round numbers, is 1,600,000, in Ohio, 4,000,000, although the number of acres *occupied* is very nearly the same, and the number of acres *cultivated* only about one-third greater than in our Provinces.

In the value of wool alone the annual difference in favour of the former is	£606,564
And in sheep at 7s. 6d. each, it is	879,405
	£1,485,969

the latter item being capital, which, deducting the expense of keep, &c., pays at least 33 per cent. per annum, net profit, and allowing for increase in numbers every year, might fairly be calculated at fifty per cent.

It must, however, be observed, that notwithstanding the striking superiority of Ohio in this particular, the rate of increase in the number of sheep, as compared with that of the United States would appear, from page 67 of Mr. Kennedy's report, to be greatly in favour of Canada, for in ten years, the increase in the States has been only ten per cent., and in the weight of the fleece only 32 per cent., whereas in Canada the increase in wool has, in nine years, been 64 per cent., and that of sheep 35 per cent., showing an improvement in the weight of the fleece of not far off 30 per cent.

The average weight in Canada is found to be:

In Upper Canada	$2\frac{14}{16}$ lbs.
In Lower Canada	$2\frac{4}{16}$ lbs.
In all Canada	$2\frac{10}{16}$ lbs.

Whilst in the United States it is, as per page 67 of the Abstract, $2\frac{7}{16}$ or $2\frac{43}{100}$ lbs., showing on excess in favour of Canada in the average of nearly 3 oz. per fleece. The proportion too in both countries i. e., the whole United States and Canada, is about the same, being about 9 sheep to every 10 inhabitants. Upper Canada has about 10 sheep to every 100 acres occupied; Lower Canada has 8, and the United States has $7\frac{17}{100}$.

With regard to horses, there are in both Canadas, according to the Census Returns 385,377, or very nearly one to every five inhabitants, and they have increased during the last nine years 48 per cent. In some counties the increase has been very much greater than this, for we find in Oxford an increase of 350 per cent., and in some townships in that county even 400 per cent.; this would induce a belief that there was some great error in the returns of 1842: but there seems to be no good reason why the number of horses should not have kept pace with the population; the wealth of the latter having also during that time so materially increased. If in nine or ten years, the population has increased cent. per cent.; it is almost unaccountable that the number of horses should not have increased in a similar ratio.

It is stated by the Census Superintendent, that in the United States, where Railways have been extensively constructed, the number of horses has very much decreased, and according to the abstract accompanying his last Report, the number in New York had decreased by 26,366; in Pennsylvania by 13,000; in New England by 77,000, or more than 25 per cent., "while in all the States (he remarks) railroad conveyance "has almost superseded the use of horses for travelling purposes along the main routes." He adds, "we would more readily attribute the apparent diminution to the omission to enumerate the horses in cities and towns than to any superseding of horse power."

There can be no doubt that this must be the reason for any apparent decrease, for the experience of other countries shows a very different effect, as produced by railway travelling.

In Great Britain, the number of horses employed at the great railway termini, and the numerous intermediate stations, very far exceeds the number formerly employed in the stage and posting departments. The facilities afforded by railway communication, and the saving of time, combined with so much greater comfort, has led to an enormous increase of travellers, and the tens who formerly travelled between the chief cities and towns of a country, either on business or for pleasure, are now multiplied to hundreds. The main routes may be comparatively deserted, but it is difficult to believe that the construction of railways, which must be fed at every point with their freights, living as well as dead, can have any other effect than an increase in the employment of horses.

The horses and mules of the whole Union, constitute a proportion of 1 to 5 of the inhabitants. New York has only 1 to 7; Pennsylvania 1 to $6\frac{6}{10}$; and Ohio has 1 to $4\frac{3}{10}$. In the new States of the West, the increase in horses has kept pace with that of the population, and so also in Canada West the new townships show a far greater increase than the older ones.

From this kind of comparison it will be seen that there are various branches of agriculture well deserving of the increased attention of the Canadian farmer.

Ohio far exceeds Canada in indian corn, butter and cheese, grass seed, wool, tobacco, and beef and pork.

Canada far exceeds Ohio in wheat, peas, rye, barley, oats, buckwheat, hay, hemp and flax, hops, maple sugar and potatoes; and also, considering that Ohio has one-third more cultivated land, in total value of live stock. This bears a proportion of only $12\frac{3}{4}$: 11, whilst the cultivated land of Ohio to that of Canada is as 10 to $7\frac{1}{2}$.

In all the above enumerated articles, viz.: live stock, grain, other farm produce, articles manufactured from flax, hemp and wool, beef and pork, Ohio exceeds Canada by £8,199,310, being very little over one-third more than the produce of Canada, and if the produce of the Forest be calculated, of which Canada exported in 1851, value for one million and a half of pounds, the relative wealth per acre would be in favour of Canada.

The ratio of increase of population in Ohio for ten years, from 1840 to 1850, is $33\frac{33}{100}$ per cent.—that of Upper Canada in the same period has been $104\frac{58}{100}$ per cent.—that of Lower Canada for seven years, from 1844 to 1851, has been 20 per cent.

When it is considered that there are 31 States, 1 District, and 4 Territories; and that Ohio has 8 per cent. of the whole population of the Union,—$8\frac{3}{4}$ per cent of the grain of the whole Union except rice,—and about $10\frac{1}{2}$ per cent. of all other agricultural produce not manufactured, and seven per cent. of butter, cheese, beef, pork and domestic manufactures of the whole union, and that Canada equals Ohio in acreable produce, is there not good reason for expecting that Canada, with her more extended scope, and her more rapidly increasing population, will, in a very few years, make a much nearer approximation to the population of the whole Union than Ohio does now.

Already the population of Canada is more than $\frac{1}{13}$ of the Union—the area in square miles, exclusive of the Territories is one-sixth, and of course in acres the same—in occupied acres about $\frac{1}{17}$—in growth of wheat very nearly one-sixth of the whole Union—in barley more than one-fourth; in oats one-seventh; in buckwheat one-eighth; in all grain, including Indian corn

about $\frac{1}{15}$,—exclusive of Indian corn about one-sixth. Of rice, Canada has none, neither has Ohio,—the whole Union produces 215,312,710 lbs., which at three pence per pound would be £2,691,408 in favour of the Union.

Even at present, Canada compares most favourably in proportion to her population with the States, and when the railroads now in course of formation shall have united the whole British possessions in North America, the increased facilities and aroused and invigorated energies, and improving climate and more rapidly increasing population, and interminable water communication, and extensive fisheries will, in a few years, enable the British North American possessions to make no unfavourable comparison with the Union, flourish as she may.

The whole area of the United States and territories is 3,230,572 square miles which multiplied by 640 gives the number of acres 2,057,566,080, certainly a prodigious territory, but the British possessions in North America far exceed this.

The exact amount according to Allison, is 4,109,630 square geographical miles, and the water in British America is 1,340,000 square miles. The whole terrestial globe embraces about 37,000,000 square miles, so that British America contains nearly a ninth part of the whole terrestrial surface of the globe—the number of acres is 2,630,163,200. Allison remarks that a very large portion is, perhaps, doomed to everlasting sterility, owing to the severity of the climate—such is no doubt the case; but it should be recollected that as the country becomes cleared up, the climate improves, and that there are at present twenty or thirty millions of acres, to the successful cultivation of which the climate presents no insuperable barrier.

Two or three centuries ago the Rhine used to be frozen, and the animals, the natives of the northern regions, were abundant on its banks—how different is the case now! It will be so in British North America, with this difference, that the improving climate will keep pace with the vastly accelerated movements, and more rapidly increasing numbers of the New World settlers.

Standards of Length and Weight.

It will be remembered that the destruction of the Houses of Parliament by fire, in 1834, proved fatal to the standard Yard and Pound. A commission was subsequently appointed to consider the steps to be taken for the restoration of those standards,—the members of which were all Fellows of the Royal Society.

The late Mr. Baily took an active part in the preparation of a standard yard; which, however, though constructed most carefully, deteriorated in such a manner as to be altogether unworthy of confidence. Since Mr. Baily's death, the Rev. Mr. Sheepshanks has been engaged in the very difficult and delicate task of constructing a standard yard,—while Professor Miller, of Cambridge, undertook to make a standard avoirdupois pound. The liberality of Government placed at Mr. Sheepshanks' command apparatus for his purpose far superior to that possessed by his predecessors. His labours were carried on in the lower tiers of cellars in Somerset House,—which are very favourable to the work, on account of their slow-changing temperature.

After an infinite number of experiments and comparisons, two standards have been constructed. The originals have been inclosed in one of the walls of the New Houses of Parliament; and perfectly accurate copies were placed by Mr. Airy in the custody of the Royal Society on Thursday last.

The standard yard measure is defined by the interval between two lines upon a bar of gun metal. The bar is about 38 inches long and 1 inch square; it is supported in a horizontal position upon eight brass rollers, which are carried by levers so arranged that the pressure upon the eight rollers are necessarily equal. The lever frame, with the bar resting upon it, is placed in a box of mahogany wood. The bar is prevented from moving endways by weak brass springs attached inside to the ends of the box, and is prevented from moving upwards by wedges of paper placed under three inverted stirrups. Near to each end of the bar, a cylindrical hole is sunk from the upper surface of the bar to the depth of half an inch, and at the bottom of each cylindrical hole is a gold pin, upon which are cut three fine lines in the direction transversal to the bar, and two fine lines parallel to the axis of the bar. The limiting points of the yard measure are those points of the middle transversal lines which are midway between the longitudinal lines. On the upper surface of the bar, the following inscription is engraved,—

Copper	16 oz.
Tin	2½
Zinc	1

Mr. Baily's metal.
Standard Yard at 62.10, Fahrenheit, cast in 1845.
Troughton & Simms, London.

—It is necessary to observe that, although the bar was cast so long ago as 1845, the standard yard has been completed only very lately.

The standard pound weight is made of platinum, representing, when weighed *in vacuo* against the last Troy pound, 6,999·9975 grains,—of which the last standard contained 5,760 grains. The form of the weight is a cylinder, with a groove surrounding it a little above the middle of its height for the insertion of the fork which is used in lifting it. On the upper end of the cylinder is engraved the following inscription:—

No. 2
P. C.* 1834.
1 lb.

—The box containing the weight is mahogany,—and when its portions are screwed together, the weight is fixed immovably. This mahogany box is placed in a second mahogany box, the lid of which bears the inscription—

Standard Pound, 1853.

—The mahogany boxes of the yard and the pound are inclosed in an oak box, upon whose lid is cut and painted the inscription—

British Standards of Length and Weight, 1853.

* This means Parliamentary Copy.

INCORPORATED BY ROYAL CHARTER.

The Canadian Institute.

The proceedings of the Session of the Institute for the year 1853-4, will have commenced before the issue of the December number of the *Canadian Journal*. We therefore proceed to

call the attention of members to certain regulations which have especial reference to the preliminary operations of the Society:—

1. The sessions of the Institute shall commence annually on the first Saturday in December; and ordinary meetings shall be held on every succeeding Saturday (omitting the Christmas holidays), until the first Saturday in April; but it shall be in the power of the Council to protract the sessions if it should seem necessary. The chair may be taken when five members are present.

2. The Annual General Meeting of the Institute shall be held on the third Saturday in December, at seven o'clock in the evening, to receive and deliberate upon the report of the Council on the state of the Institute, and to elect the officers and members of the Council for the ensuing year,

3. The Council shall draw up a yearly Report on the state of the Institute, in which shall be given an abstract of all the proceedings, and of the receipts and expenses of the past year to be accompanied by vouchers; and such report shall be read at the Annual General Meeting.

4. The President, First and Second Vice-Presidents, Treasurer, two Secretaries, and Curator and Librarian. (with six members to form a Council), shall be elected annually by ballot, at the general meeting on the third Saturday in December; and if that day fall upon a holiday, then upon the following Saturday.

5. That all persons to be eligible as officers of the Institute, and members of the Council must be put in nomination at the ordinary meeting immediately proceeding the annual general meeting.

6. Any member being nominated to an office and not elected thereto, shall be eligible to be elected as a member of the Council.

7, Every member voting at the annual election, shall deliver to two Scrutineers, appointed by the Chairman, a list containing the names of the persons he may be desirous of having elected as members of the Council for the ensuing year, specifying the offices for which he proposes them to be elected; the Scrutineers shall mark the name of every member so delivering his list, and if no valid objection be made, the same shall be accepted. *Votes of country members for the election of officers communicated in writing to the Secretaty shall be valid.*

8. Those members ot the Institute residing at a distance from the city, shall have the power of forming themselves into Branch Societies for the purpose of holding meetings, and discussing scientific and other subjects; and are to be governed by the regulations of the Institute, and such other By-laws hereafter to be enacted by them and approved by the Council.

Museum of the Canadian Institute.

We have recently had the pleasure of examining a very handsome collection of fossils and Indian remains presented to the Museum of the Canadian Institute by George Bell, Esq., of Simcoe. The specimens number over one hundred and fifty, and among them are to be found some corals, madrepores, tubipores, and shells of great beauty, and in good state of preservation. Mr. Bell, in his communication to the Librarian and Curator of the Institute, states that, "the corniferous fossils have been found in various localities in the townships of Oneida, Walpole, Woodhouse and Townsend, and a few rolled species of stone in Windham and Charlotteville; but, as nearly all are characteristic, there is no doubt of their belonging to the same formation. I have heard a doubt expressed as to the Leptæna Depressa being found higher than the Niagara Limestone*; but about the specimens sent there can be no doubt, as they were all taken by myself from the rock *in situ*, part at Dover, and part five miles north of that place. I send also an Indian stone-axe and chisel, with a few arrow-heads and a singular perforated stone (probably a bead) from Charlotteville; also, some arrow-heads and fragments of pottery from Windham. The last are not good samples, but having some room to spare in the box, I put in a few pieces of such as I had at the time, expecting hereafter to get some better specimens."

Dr. Wilson, of Perth, has contributed an important addition to the Museum in the form of a fine selection of minerals, some being peculiar to Canada as far as is yet known of their distribution. Dr. Wilson's donation embraces twenty species, to many of which duplicates and triplicates are attached. This is an important item in the formation of a museum, as it permits exchanges to be made for unrepresented specimens.

We notice with particular pleasure these valuable contributions of Mr. Bell and Dr. Wilson; they will serve to attract attention to the magnificent science of geology, one which is second only to astronomy in the grandeur of its speculations and the imposing aspect of its present developments, and one which may vie with astronomy in its bearings upon the progress of the arts and the happiness of mankind.

* *Leptæna Depressa*, known also by the names *Strophomena Depressa*, *Productus Depressus*; is an exceedingly beautiful shell, strongly marked with undulations, crossed by striæ. We have found this shell at Woodstock in the Valley of the Thames. It is to be met with in the Clinton Group, and very abundantly in the Niagara Group, and certainly as high as the commencement of the Hamilton Group.—(*Ed. Can. Jour.*)

The Canadian Journal.

We direct the attention of subscribers to the advertisement of A. H. Armour & Co., which appears on the cover of the present number. The October number was delayed in its publication some days longer than might reasonably be attributed to the supplement which accompanied it. This was occasioned by the great inconvenience and delay with which the removal of Mr. Scobie's Printing Establishment to more commodious buildings was necessarily attended.

We have also to call the attention of Members of the Institute to the Circular which appears on the fourth page of the cover. It is earnestly hoped that the attendance of Members at the Annual General Meeting, on December 17th, will fully establish the expectations which the last annual conversazione originated.

Robert Stephenson, M. P.*

The two new Engines constructed by Mr. Stephenson—the "Phœnix" and the "Arrow"—had a more extended flue surface than the "Rocket," and were subjected to a series of experiments resulting in further improvements; increasing the steam generating capacities of the boilers, simplifying the working parts of the engine, and materially increasing their power and speed. The twenty miles per hour of the "Rocket" was soon increased to fifty, and even to sixty miles per hour in some of its successors; and the Stephensons' Manufactory at Newcastle became the largest and most celebrated in existence, sending its products to the United States, and to all parts of the world where Railways were introduced.

Previous to the opening of the Liverpool and Manchester Railway in 1830, Robert Stephenson undertook the survey of the first line projected from London to Birmingham. This survey was commenced in October of that year, but so many important points for consideration presented themselves to him, that though the plans required by the then standing orders of Parliament were prepared and deposited by the end of November, yet by his advice the Bill was not then brought forward, in order that he might be afforded time for a more mature consideration of them. In pursuance of this determination, he devoted the greater part of the ensuing year to a minute examination of the country between London and Birmingham, and in the November of 1832 completed and deposited plans of the line in every important particular the same as it now stands.

In consequence, however, of the strenuous opposition made by the Grand Junction Canal Company and the land owners on the line, the Bill was thrown out by the Committe of the House of Lords. In the ensuing session, however, the same plans, with slight modifications, were again deposited, and after a hard Parliamentary struggle, the Bill received the Royal Assent in July, 1833.

The immense cost entailed upon the Railway Companies of the United Kingdom by the opposition to their charters offered by ignorant and interested parties both in and out of Parliament has, fortunately, no parallel in this or any other country. It is painful to reflect on, as it would be humiliating to record, the ignorant prejudices and cunning artifices by which the promoters and engineers of the great "Iron Ways" of Great Britain were thwarted in the commencement of their enterprises; instead of receiving with gratitude the great invention by which the public has been enabled at half fares to travel at four times the speed they had formerly attained, and whereby millions of tons of merchandize have similar advantages, the engineers engaged in locating the lines had every possible impediment placed in the way by the community they so much benefitted. In most cases these obstructions recoiled with disastrous effects on those who offered them, and in many instances the opposition offered by the inhabitants of country towns has prevented new life and vigour being infused into their dull and stagnant population by the facility afforded by Railway communication—nor is this all; the immense increase of cost per mile, which these Parliamentary struggles have caused, demand a corresponding increase in the tariff levied on the goods and passengers carried, and hence it follows that with an infinitely less amount of traffic on American lines, they yield a better profit with fares at two cents per mile, than English Roads with fares at double that rate. Much of this result is due to the enormous law costs of the English Roads; and it has been estimated that in the three years 1845, 1846 and 1847, upwards of ten millions sterling were wasted in Parliamentary enquiries and contests,—a sum sufficient to construct a complete system of railways in these Provinces—and it has also been asserted that previous to 1850, more than fifteen millions had been similarly wasted.

The proprietors having fought the bill through Parliament, the construction of the London and Birmingham line was commenced in June, 1834, and Mr. Stephenson having made arrangements with the directors to devote his time exclusively to the execution of the works on their line, he removed from the superintendence of the engine manufactory at Newcastle, and resided in London, where he applied himself assiduously to the accomplishment of his great undertaking—a portion of which, from London to Boxmoor, a distance of twenty four miles, was first opened; that from Boxmoor to Denbigh-Hall, twenty-one miles, was opened in the autumn of 1837; and from Birmingham to Rugby, twenty-one miles, was opened in 1838,—finally, the whole line was opened for public traffic on the 17th September in the same year.

Among the many difficult works on this line, the most prominent are the Blisworth cutting, the Tring cutting, and the Kilsby tunnel—all between Rugby and Denbigh Hall.

The Blisworth cutting, though not the longest on the line, was from the character of the material the most expensive. The Tring cutting contained the greatest quantity, but being of chalk, less difficulty was experienced than in the Blesworth, which consisted chiefly of hard, blue limestone, yielding at all seasons large quantities of water, which it was necessary to drain by pumping. The working of the rock in this cutting was rendered more difficult than it would have been, by the rock being interstratified by beds of blue shale, impervious to water, rendering every means of drawing it off except that of pumping, unavailable. The Blisworth cutting contained 1,200,000 cubic yards, and averaged 50 feet in depth for a distance of two miles. About 400,000 yards of the material was removed from each end to form adjoining embankments, which reached the height of 45 feet, and the remaining 400,000 yards were raised up the steep sides of the excavation, and deposited on the adjoining land in spoil banks. The cost of the excavation exceeded £200,000 sterling.

The Kilsby Hill was a still more formidable work than the last, for its execution was not only impeded by bad material and an immense flow of water; but the means for overcoming them were confined within the narrow limits of a tunnel. After the trial shafts had been sunk, the works were let by competition for the sum of £99,000 sterling, and were in busy progress when it was ascertained that at about 200 yards from the south end, there existed a thick quicksand, which the trial shafts on each side had just passed without touching. In view of this unforeseen difficulty, it became apparent that additional means beyond those already contemplated were necessary, and the contractor was in consequence relieved from his responsibility, the contemplation of which is said to have caused his death. So great indeed was the difficulty, that it became a question whether the execution of the Kilsby Tunnel should be abandoned or continued. Mr. Robert Stephenson, however, after mature reflection, offered to undertake the responsibility of continuing it, and he was authorized to do so. Extra shafts were sunk, and four powerful pumping engines were erected, which continued to pump from the quicksand for six months, with scarcely a day's intermission, at the rate of 1800 gallons of water per minute. By these means the difficulty of tunnelling was reduced, but still the operation was one of great difficulty and danger. On one occasion, those who were nearest the quicksand, in driving into the roof were almost overwhelmed by a deluge of water. A gang of workmen were sent to their assistance, with the requisite material on a raft in order if possible, while the utmost power of the engines were exerted, to close up a short length of the arch; the water rose,

* Continued from page 64.

however, with such rapidity that they were compelled to retreat, and were near being jammed against the crown of the tunnel. For a considerable time all the pumping apparatus appeared insufficient; so much so that the Directors almost determined to abandon it, but the perseverance of Stephenson prevailed, and he had at length the satisfaction of seeing the water recede before the power of his engines.

The tunnel is 2,400 yards in length, or nearly a mile and a half; it is 25 feet wide and 28 feet high, and is ventilated by two large shafts, each being 60 feet in diameter—one being 120 feet deep, and the other 90 feet; they effect so perfect a ventilation, that within a few minutes after the passage of a train, the smoke and vapour is carried off, so that the opposite end may be distinctly seen.

The time employed in constructing this stupendous work was thirty months; there were 36,000,000 of bricks used in it, and it cost £300,000—nearly three times what it would had the difficulties been of an ordinary character. This line of railway has eight tunnels of similar dimensions, that is 25 feet by 28 feet.

The most important bridge on the line is the Wolverton Viaduct, it is erected over the Ouse, near Stony Stratford, and consists of six semi Eliptical Arches, each 60 feet span, the roadway being elevated about 50 feet above the ordinary level of the Country. This Viaduct (except the coping which is of stone) is entirely composed of brick. The aggregate amount of excavation on the whole line amounted to about 15,000,000 of cubic yards, being equal to an average of 142,000 cubic yards per mile, and was completed in the short space of four years from its commencement.

The above figures indicate an expensive line, and accordingly we find that the favourable grades and curves have been obtained at a cost of about £42,000 per mile!

During the construction of the London and Birmingham line, the Belgian Government consulted Messrs. George and Robert Stephenson, as to the best system of railways to be adopted in that country. On their advice a cross of Trunk lines, extending from Ostend to Liege on the one hand, and on the other, from Antwerp through Brussels, to be connected with Mons and Valenciennes (making in all 347 miles) was adopted, and authorised by law in 1834. The Stephensons were both decorated by the King of the Belgians with the Ribbon and Cross of the Legion of Honor. These lines were completed and opened in 1844.

After completing the London and Birmingham line, Robert Stephenson, in conjunction with his Father, undertook the construction of various lines of railway, embracing a length of about 1800 miles, and for ten years were incessantly engaged in the Parliamentary Contests, originating the great net work of lines extending over all parts of the Kingdom.

The Birmingham and Derby, the North Midland, York and North Midland (to which the elder Stephenson chiefly devoted himself), the Manchester and Leeds, and the Northern and Eastern, were all constructed under Robert Stephenson and his Father; and during the same period the former as Chief Engineer, constructed the great Iron Cross of Roads which connect London with Berwick on the one hand, and Yarmouth with Holyhead on the other.

The York, Newcastle and Berwick line is one of the greatest of Stephenson's works, and in its length is the magnificent High Level Bridge over the Tyne, at Newcastle, and the beautiful Viaduct of twenty-eight arches of 125 feet in height, and 61 feet 6 inches span across the Broad Valley of the Tweed at Berwick, connecting the North British line with the York, Newcastle and Berwick, and completing a continuous railway route from London to Aberdeen.

Though not personally superintending his engine manufactory at Newcastle, Mr. Stephenson still continued to design and introduce various improvements into the locomotives there manufactured; amongst them the most important is the "Link Motion." It is probable that he was not the originator of this beautiful piece of mechanism, though it was first applied to his engines. Various arrangements of the valve-geering had been used for introducing the expansive action of steam, and for reversing the engine—while the working of the simple slide-valve was effected in almost as many different modes as there were makers of engines. Generally, their plans were so complicated as to cause very serious expense in maintaining them in repair, and the ordinary wear in so many working parts produced a derangement in the valves, necessarily resulting in a serious loss of power. It was therefore an important matter to simplify these parts, and still more important to preserve and improve the means of adjusting as circumstances required, the amount of expansive action given to the steam.

To Mr. John Gray is due the merit of the first application of the expansive principle by varying the travel of the valve, a principle of primary importance, though originally embodied in a complicated and inconvenient piece of geering.

Mr. Cabrey, of the North Midland Railway, accomplished the same effect in a more convenient form, and following up the same idea, Mr. Williams, at one time of Newcastle, suggested the germ of the link motion in a form, which, though rude and impracticable, still embodied the principle: and that principle, when further perfected, became in conjunction with the "lap" of the valve, the most important acquisition to the locomotive since the introduction of the blast-pipe and the multitubular flue.*

Since the application of the link motion to Stephenson's Engines in 1843, by Mr. Howe, but little has been done to improve its action—substitutes for the "link" have been proposed with no very tangible object except the saving of an eccentric—and though from not having been properly investigated, the correctness of its action has been denied by some; it has been gradually adopted by nearly all English manufacturers, and is now generally used by manufacturers in America.

No improvement has done more to economise the cost of working a railway than the introduction of the expansive principle into the Locomotive, and no contrivance so perfectly accomplishes that object as the "link motion."

* In order to exhibit the value of the lap of the valve, we introduce a tabular statement of the result of experiments made on the Liverpool and Manchester Railway, in 1842-'3, with a view to test the value of the changes made in the valves,—as affecting the consumption of fuel.

Gross consumption of Coke per mile.

49 lbs. average consumption of Company's Engines in the summer of 1839, with old Valve.
40 lbs. average consumption of Company's Engines, after the introduction of the new mode of Coke deliveries,—old Valve.
36 lbs. new Valves with $\frac{1}{2}$ inch cap.
32 lbs. new Valves with $\frac{3}{4}$ inch cap.
28 lbs. new Valves with 1 inch cap, as applied to old steam and exhausting passages.
23 lbs. same Valves and same Engines, with increased care in firing, so as to avoid all unnecessary waste of fuel.
15 lbs. Valves with 1 inch cap, as applied to the new Engines, with enlarged exhausting passages, larger tubes, and closer fire bars, and greater accuracy of construction.

*Notices of Books.

Governor Christie aided us, by every means in his power, as well in procuring a fresh supply of provisions as in recommending to us the men best qualified to manage a canoe, and to guide us over the difficult and dangerous return route upon which we were about to enter.

While detained at the Assiniboin Colony by these preparations for our return, I had an opportunity of making a short visit, which interested me much, to a settlement of about five hundred Cree Indians, residing below the colony, at Prince Rupert's Landing. They are decidedly the most civilized tribe which I have seen or heard of in the North. These Indians support themselves mainly by the produce of their farms, which they cultivate with their own hands. They dwell in comfortable squared log buildings, erected, thatched and whitewashed by themselves. They are acquainted with the use of the simpler farming utensils, and the mechanical operations necessary to keep their farms and houses in order. Each family cultivates from five to ten acres of land, which is kept well fenced. They mow their own hay, and feed their cattle on it in the winter. A few occasionally hunt during a month or more in the summer, or when their crops do not require much attention; but this is more for recreation than for support. Some of the men occasionally contract with the Hudson Bay Company to transport their goods to and from York Factory, on Hudson's Bay.

The remarkable change in the habits and customs of these Indians has been wrought mainly through the force of example, by Mr. Smithhurst, who resides among them as missionary, and who is thoroughly conversant with their language. That gentleman is remarkable for his love of order and is devoted to agriculture and horticulture. His house is situated in the midst of a delightful little flower garden, kept in beautiful order, with flourishing fields of grain and meadows in the rear. The Indians, having continually before their eyes so pleasing and practical an example, of the comforts of a civilized life, as well as an illustration of the means by which, in a rigorous climate, they may be enabled to provide for themselves a support far more stable and certain than that derived from the chase, have gradually fallen into the habits of their instructor, and, by degrees have gathered around their permanent houses the implements and appurtenances, and even some of the comforts and luxuries belonging to the thrifty farmer. It is true they are sometimes accosted contemptuously by their neighbours, the Chippewas, and ridiculed as earth-worms and grubs: but they now retort upon them :—"Wait till the winter sets in, and then you will come to us, beggars for our surplus potatoes and indifferent peas."

The evening we were there, several young lads were engaged in sharpening their scythes, preparing to go out, next morning, in a party to mow.

The general agricultural character of the Red River country is excellent; the land is highly productive, especially in small grain. The principal drawbacks are occasional protracted droughts during the midsummer months, and, during the spring, freshets, which from time to time, overflow large tracts of low prairie, especially near the "Great Bend." Its tenacious subsoil insures its durability.

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The Lake Superior country presents four principal varieties of soil: a drift-soil, similar in its ingredients to that just mentioned; a red clay and marly soil, prevalent over the high plains bordering on the coast, and the corresponding lands on the adjacent islands; a trap soil of limited extent, near the foot of the igneous outbursts, and finally, alluvial bottoms, which are confined exclusively to a small body of land on the east fork of Bad River.

The drift-soil prevails through the highlands, six hundred to one thousand feet above the level of the lake; also over the high grounds of the promontory, west of Chegwomigon Bay, at a height of three hundred to six hundred feet, and the higher points of the neighbouring Apostle Islands. These lands, owing to their inferior siliceous soil, and the abundance of erratic blocks disseminated over them, are hardly fit for cultivation.

The trap soils, which support a growth of sugar maple, oak, and other hard woods, are next in richness to the alluvial lands. They are found chiefly on high ridges and slopes, which, at the east and west ends of the district, are only a short distance from the lake shore; but on the waters of Bad River and the Brulé, they recede three-fourths of the distance back, towards the sources of their various branches.

With these trap soils of the Lake Superior country, may be classed the lands in the vicinity of Big Bull Falls, and south of Beaulieau's Rapids, on Wisconsin River; the Pokegoma country, bordering the lake of the same name in Minnesota, the immediate vicinity of the Falls of St. Croix, and a portion of the Snake, Kettle, and Little Rock River countries; since the soil of these localities originates from rocks of similar composition.

The red clay and marl lands, occupying the high plains skirting Lake Superior, are characterized particularly by the predominance of oxide of iron, from which they derive their colour, and which amounts to four and a half per cent., or nearly one-half of the weight of the saline matter; it is always a retentive soil, from the abundance of argillaceous earth which enters into its composition, hence these red clay and marl lands are often wet, particularly when defended from the direct rays of the sun, by the dense growth of cedar, balsam, spruce, birch and hemlock that usually covers them. Still these lands are not so wet, but that by clearing and a judicious system of husbandry, they would soon become sufficiently dry for most kinds of crops and garden vegetables.

Lake Superior has, at times, not only the varied interest, but the sublimity of a true ocean. Its blue, cold, transparent waters, undisturbed by tides, lie, during a calm, motionless and glassy as those of any small secluded lake, reflecting with perfect truth of form and colour, the inverted landscape that slopes down to its smooth sandy beach. But when this inland sea is stirred by the rising tempest, the long sweep of its waves, and the curling-white caps that crest its surface, give warning not only to the light bark canoe, (still much used along its shores) but also to sloop and schooner and lake steamer, to seek some sheltering haven. At such times, craft of every description may be seen running before the wind, or beating up against it, all making for the most favourite harbour on the lake—the sheltered bay of Madeline Island.

As a site for a town, and especially as a place of resort for health and pleasure, La Pointe offers advantages beyond any portion of the mainland in Wisconsin. Its surface is sufficiently level and extensive for all purposes of agriculture; its soil, a retentive red marl, is capable, under a proper system of tillage, of returning to the husbandman a hundred-fold, and of producing fruits and vegetables in perfection. Its gently sloping and sandy beach, insures a secure footing to the bather. As a fishing station, it is unrivalled. The Bays and creeks of the numerous islands and main shore, distant only a few hour's run, are amongst the best fishing grounds on the whole lake, for trout, siscowet (*Percopsis Guttatus,*) and white fish or lake shad (*Coregonus Albus.*)

Tempered as well in summer as in winter, by the vast expanse of water which surrounds it, and which, except at the immediate surface is almost always at 40° Fahrenheit, its climate is milder, at once, and more equable, than any part of Wisconsin, whether it be on the mainland of Lake Superior, or further south, on the Mississippi. Chiefly for this reason, but also on account of the bracing winds that sweep across the lake, Madeline island is probably not surpassed, in point of health, by any locality throughout the entire western country.

The prairie country, based on rocks belonging to the Devonian and Carboniferous systems, extending up the valleys of the Red Cedar, Iowa and Des Moines, as high as latitude 42° or 42°31′, presents a body of arable land, which taken as a whole, for richness in organic element, for amount of saline matter, and due admixture of earthly silicates, affords a combination that belongs only to the most fertile upland plains.

Throughout this district, the general levelness of the surface, uninterrupted only by gentle swells and moderate undulations, offers facilities for the introduction of all those aids which machinery is daily adding to diminish the labour of cultivation, and render easy and expeditious, the collection of an abundant harvest. There are, it is true, limited spots, less desirable for farming purposes, where the ground is liable to be overflowed by the adjacent streams, in times of freshets, and where local geological causes operate to alter the composition of the soil; or where, from too uniform a flatness of ground, near the sources of streams, water stagnates; these form, however, but a small fraction of the whole.

The greatest drawback to the settler in these portions of Iowa, is the limited extent of timber, which is chiefly found in belts and groves lining the borders of rivers, gradually diminishing in quantity, as a general rule, towards their heads. This disadvantage is in part counterbalanced by the ease with which a farm can be commenced and brought under cultivation.

Nevertheless, with proper economy and a little thought, an ample supply both of fuel and farming timber, may, in most instances, be insured. Again, the great extent of the coal district, throughout a large area of this prairie country, renders the consumption of timber for fuel unnecessary.

* Continued from page 80.

The portion of Iowa which is most deficient in timber is north of latitude 42°, especially on the dividing ridges. North of this latitude between the head waters of Three and Grand Rivers, there are distances of ten or fifteen miles without any timber: while between the waters of Grand River, the Noduway, and the Nistinabotona, the open prairie is often twenty miles wide, without a bush to be seen higher than the wild indigo and the compass plant. The soil, too, in this region, is generally of inferior quality to that south of latitude 41° 30′.

After passing latitude 43° 30′, and approaching the southern confines of the Coteau des Prairies, a desolate, barren, knobby country commences, where the higher grounds are covered with gravel and erratic masses, supporting a scanty vegetation, while the vallies are either wet and marshy, or filled with numerous pools, ponds and lakes, the borders of which are inhabited by flocks of sandhill cranes, which fill the air with their doleful cries, and where the eye may often wander in every direction towards the horizon, without discovering even a faint outline of distant timber.

This description of country prevails for about three quarters of a degree of latitude, and between three and four degrees of longitude, embracing the water-shed where the northern branches of the Red Cedar, and the Iowa, and the eastern branches of the Des Moines, take their rise. After passing the extreme sources of the Mankota, the country again improves, both in quality of the soil and in the distribution of timber. On fairly entering the valley of the Minnesota River we again find a fertile, well watered, and desirable farming country. The second terrace of land bordering the Minnesota, may be especially cited for its fertility and advantageous position, elevated entirely above the highest freshets, and in proximity to a belt of forest which crosses the Minnesota about latitude 44° 30, and which is remarkable for its unusual body of timber, in a country otherwise but scantily supplied with wood.

The Crystal Palace at Sydenham.

The Crystal Palace rebuilding at Sydenham, is so far advanced that Messrs. Fox & Henderson have undertaken to surrender it to the company in a finished state at Christmas.

The following description of its proposed arrangements is interesting:—

The south-eastern end of the palace is so far finished that the plan of the interior decorations already begins to develop itself A large number of gardeners and their assistants have been for some time busily arranging plants and shrubs in beds and borders of different forms: and the statue of Charles II., which forms the most prominent object in this portion of the building, is now almost embowered in plants and flowers.

No less than 12,000 camelias and a proportionate number of geraniums, pelargoniums, with orange trees and other plants and shrubs, have been already arranged in this space. They are at present in pots, but the flooring will be cut away, according to the plans marked out, the beds filled up with mould, and the plants then transferred to their future destination. The centre will be occupied by a lake extending a considerable way up the nave, and here all kinds of aquatic plants will be placed. The site and extent of this inland sea are already indicated by the brickwork, and the points at which it will be spanned by light and elegant bridges marked out. The great subject of attraction at this end of the building at present, is what is termed the Pempeian Court—a *fac simile* of a building discovered when excavating the ruins of Pompeii. Here the visitor will have an opportunity of observing the style and character of Roman architecture and embellishments upwards of 1800 years ago, reproduced in all its most minute details, and with all its original richness and brilliancy of colouring.

The building is formed of an open court, with smaller apartments surrounding it. The centre is occupied by a fountain, and groups of richly gilt winged figures support the sloping roof, the emblematic paintings and ornaments being of the most graceful and delicate character. In the large apartment opening out from the central court, termed the peristyle, there are double ranges of columns enriched with paintings, and flowers and statues, niches for the Penates, or household gods, and other accessories show this to have been the state apartment in which visitors were received and the banquet spread. It is, however, at the north-western end of the building that the greatest progress has recently been made.

The first court nearest the central transept, is devoted to the illustration of ancient Egyptian and Assyrian architecture and decoration. It will, when completed, be approached from the central nave through a large gateway bordered with shrubs and flowers, and passing up through a long range of richly decorated columns, will disclose well-arranged groups of tombs, idols, sphynxes, and gigantic figures, one of which, seated, will be thirty or forty feet high. This court is much further advanced than any other portion of the works, and is at present receiving its rich and brilliant colouring. Its superintendence and arrangement have been entrusted to the distinguished oriental traveller Bonomi.

Another step, and we pass to the perfected forms of the Greeks and Romans: and here, in a series of courts opening into each other, are placed statues and groups of figures, comprising casts from all the most celebrated works of the ancients. Among them are a large number of nude figures of Apollo, Baccus, Hercules, Jupiter, Athletæ Droscorodi, Satyrs, &c. On the opposite side of the nave, and next the terrace, is an Italian court, and one illustrative of the florid style of decoration which prevailed during what is called the Renaissance.

Beyond these is the mediæval court, which is considerably advanced. and which will exhibit specimens of Gothic architecture and decorations, many of the examples being taken from the old cathedrals of this country, and in connection with this will be a row of cloisters with quaint buttresses and groined roof, the whole forming a very perfect school for students and antiquarians Advancing still further, we reach courts which are to illustrate the details of Moorish architecture. The pillars of the Alhambra are just rising from the floor, and the outlines of the Court of Lions, with its great central fountain, the Hall of Justice and the other gorgeous illustrations of this luxurious Oriental style are only just developed.

Great changes are taking place in the exterior, the original design having been so far departed from or improved upon, that two wings proceeding from either extremity of the building, are now in the course of construction, with the object of affording additional space. One advantage gained by these wings will be, that they will mask the lofty forcing pumps. The terrace and gardens, notwithstanding the unfavourable state of the weather, have been considerably advanced, and large quantities of trees and shrubs have been planted. The wells have been sunk, pipes for the supply of water laid down, and steam engines for the purpose of working the pumps erected in remote parts of the grounds.

The flights of stone steps conducting from the grounds to the principal entrance have been decorated with sphynxes, and two large statues have just been completed for the terraces—one is by Monti, representing Italy, a female figure, crowned with turrets, and holding in one hand a laurel crown, and in the other implements connected with the arts. The other is by Mr. J. Bell, and represents Australia, also a female figure, bearing a crook, and extending her left hand, filled with "nuggets" of native gold. She stands upon a rock, which is also veined with gold, and a kangaroo and its young crouch at her feet. These are only the commencement of a series of similar decorations and embellishments which are designed for the grounds, and during fine weather, the arrangements are such that recreation and instruction will be judiciously combined in the open air.

A very interesting department has its temporary location in a corner of the gardens near Annerley-road. This is the restoration or reconstruction of antediluvian monsters, under the superintendence of Mr. Waterhouse Hawkins, who has undertaken to place before visitors of the palace the gigantic animals and reptiles who peopled the earth before it became a fitting habitation for man. Among the inhabitants of "the world before the flood," who are to be resuscitated, are the labyrinthodon, a gigantic frog, upward of seven feet long—the plesiosaurus, an animal of the same species, with an enormous dragon's head and jaws.

The unwieldy megatherium, the iguanodon, and other huge reptiles will also be represented, and to render the illusion more complete, they will be placed upon two islands in the large reservoir, surrounded by the shrubs, ferns and brushwood which formed their habitats. The modern section of natural history is being proceeded with in a corner of the building, and many large and fierce animals, denizens of the tropical forests, are already prepared, in the act of crouching or springing on their prey.

A numerous population is rapidly springing up, or rather settling down, around the Crystal Palace—new roads are now being formed, private houses and villas erected, and taverns, coffee-houses and hotels starting up, as if by magic, in all directions

To the Editor of the Railway Gazette.

Ammonia in Rain Water, River Water, and Snow.*—Sir: As I conceive that one fact adduced on admitted authority will have more influence in the advancement of truth than a volume of demonstrative reasoning, I am induced, in reference to the papers which appeared in the *Mining Journal* of 1849 and 1851, to trouble you with the results obtained by M. Boussingault, of the French Institute. "It appears

that the greatest quantity of Ammonia is contained in rain water. Some that had fallen on the roof of the Paris Observatory yielded four milligrammes in the French litre; while the water of the rivers does not contain 1-10th milligramme in the same quantity. That snow gathered after lying 36 hours on some fields, yielded ten times more Ammonia than that gathered immediately after it had fallen." That the softness of rain water is referable to Ammonia has long been admitted; but, until the appearance of my papers, it was conceived that this quality was acquired from the atmosphere. It is, therefore, much to be regretted that no reference is made to the relative proportion of Ammonia in rain and snow water, or such information could not have failed in throwing much light on one of Nature's most important operations—a deficiency, it is hoped, the *savans* on this side of the Channel will make good during the coming winter; and it is also to be hoped they will be induced to inquire into the *cause* of the startling fact, that snow 36 hours' old should be so much more Ammoniacal than that just fallen—it being reasonably to be inferred that this increase is not acquired from the soil, since rain, in its passage through the earth, *parts* with its Ammonia at all periods of the year. The course I suspect to be purely electrical; and if it should so happen that the Ammonia of the just-fallen snow corresponds in amount to that of rain, we shall have acquired evidence of the very simple means by which the Creator ensures to the northern regions a supply of this essential to the production of nitrogenous matter. This is unquestionably the decomposing era of the earth's *present* cycle in the creation; and, in reference to the second paragraph of Mr. Ennor's letter of the 3rd inst., I beg his attention to the fact, that Ammonia, like Lime, is a solvent of the mineral kingdom, and that snow is mostly deposited on the tops of hills or mountains, where its ammonia and water would have a levelling influence. Reckless of the consequences, we persist, year after year, in adding to the earth's surface by combustion, at least 60,000.000 tons of carbon, thereby causing the evolution of thousands of millions of *tons* of gases that cannot fail in producing a most powerful influence on both the atmosphere and earth; and cholera, influenza, potato, &c., disease, deluges of rain, and "strikes," are the fruits. Surely, then, the evidence afforded by M. Boussingault will induce at least an enquiry.

FRANKLIN COXWORTHY,
Author of "Electrical Condition."

Maresfield, Sussex, Oct. 17, 1853.

LOCOMOTION BY COMPRESSED AIR.—The obstacles which have till now opposed the employment of the expansive force of compressed air will, it is thought, disappear, through the process of M. Juliene, which consists simply in compressing air by means of an hydraulic press. By this method, M. Juliene substitutes for the solid piston—which a grain of sand may alter, which the slightest irregularity in the pump would throw out of action, and which becomes heated by friction—a liquid piston, not less incompressible than the other, filling always exactly the space in which it moves, be it regular or not, and acting by progression on a resistance so exactly calculated, that this proportion, although increasing, is always in relation to the force to be overcome. The air is thus compressed at 30 atmospheres in iron bottles, which are about 4 millimetres thick. It is perfectly preserved under this pressure; and it was with a bottle of this kind that M. Juliene put in action a small vehicle, carrying two persons, and moving with great rapidity.—*American Journal.*

ARTIFICIAL PRODUCTION OF DIAMOND POWDER.—Some considerable sensation has been produced in the scientific circles of Paris by the announcement of the artificial formation of diamond powder. M. Despretz has made two communications to the Academie des Sciences upon carbon. In these he states that placing at one, the inferior, pole of a voltaic battery a cylinder of pure charcoal (its purity being secured by preparing it from crystalised white sugar candy), and at the superior pole a bundle of fine platinum wires so arranged that the charcoal was in the red portion of the electric arc, and the plantinum in the violet,—he found the carbon volatilised, and collected on the plantinum wires in a changed state. In these experiments the current has been continued during a month in activity, and the powder collected on the wires has been found to be sufficiently hard to polish rubies with great rapidity, and when burnt it left no residue. M. Despretz asks himself,—Have I obtained crystals of carbon, which I can separate and weigh, in which I can determine the index of refraction and the angle of polarisation without doubt? No; I have simply produced by the electric arc, and by weak voltaic currents, carbon crystalised in *black octohedrons*, in *colourless and translucent octohedrons, in plates* also *colourless and translucent*, which possess the hardness of the powder of the diamond, and which disappear in combustion, without any sensible residue.—A similar result has been obtained by decomposing a mixture of chloride of carbon and alcohol by weak galvanic currents. The black powder deposited was found to possess equal hardness with that which was sublimed, and rubies were readily polished by it. A few years since, graphite and coke were formed from diamonds: we now appear to be advancing near towards the conversion of graphite and coke into diamonds.

ARTIFICIAL PEARLS.—An oyster, or rather a water muscle, in which the artificial pearls are formed by the Chinese, has recently been sent to this country. These pearls are only obtained near Ning-po, and until lately very little was known of the manner in which they were formed. The *Hermes* steamer, however, on a late visit to that place, was able to obtain several live ones, in which, on being opened, several pearls, as many as 18 or 20, were found in the course of formation. The one sent only contains simple pearls adhering to the shell. It appears they are formed by introducing small pieces of wood, or baked earth, into the animal while alive, which, irritating it, causes it to cover the extraneous substance with a pearly deposit. Little figures made of metal are frequently introduced, and when covered with the deposit, are valued by the Chinese as charms. These figures generally represent Buddha, in the sitting posture in which that image is most frequently pourtrayed. Several specimens have, it is said, been preserved alive in spirits, and others slightly opened, so as to show the pearls. The society has reason to believe that it will shortly receive a more detailed statement, accompanied with specimens, in reference to this interesting fact.—*Jouanal of the Society of Arts.*

DEEP SEA SOUNDINGS.—A brig of war, bearing the stars and stripes of the United States at her masthead, is now lying in the Southampton waters, and engaging the attention of practical and scientific men. She is called the Dolphin; and her object in the Atlantic is to procure the data desired by Congress for the use of Lieut. Maury. She left Chesapeake Bay 3 months ago. Her first task was, to strike a line from that bay to Rockule, on the west coast of Scotland, and take soundings at intervals of 100 miles along it. From Rockule, a second line was run to the Azores; a little to the north of which a ridge, 6,000 feet in height from the ocean bed, was discovered,—the soil on this elevation being a fine yellow chalky substance, mixed with fine sand. From the Azores the explorer made a westerly cut,—everywhere finding bottom and everywhere noting the set of tides and currents, and the temperature of the water. The Dolphin next steered for the Three Chimnies, where she found bottom at a depth of 1900 fathoms. The greatest depth of water was found in lat. 41° to 43°, long. 51° to 56°,—where the line fell out 3,130 fathoms. In a few days the Dolphin will have completed her outfit,—when she will make for the western side of the Azores, and pursue this series of important discoveries. The Dolphin is admirably fitted up for her work, and her sounding apparatus is the finest ever seen in Europe. Hitherto a continuous series of soundings in deep water has been rendered difficult by the fact of each sounding costing the ship a fresh line; however strongly the line was made, when once out it has never been recovered. The Americans have invented a mode by which the weight on touching the bottom is detached,—so that the line may be drawn back with ease. We borrow from the *Daily News* an account of this ingenious contrivance:—"A hole is drilled through a 64 lb. or heavier shot, sufficiently large to admit a rod about three quarters of an inch in diameter. This rod is about 12 or 14 inches in length, and with the exception of about 1½ inch at the bottom, perfectly solid. At the top of the rod are two arms extending one from each side. These arms being upon easily acting hinges, are capable of being raised or lowered with very little power. A small branch extends from the outside of each of them, which is for the purpose of holding by means of rings a piece of wire by which the ball is swung to the rod. A piece of rope is then attached by each end to the arms, to which again is joined the sounding-line. The ball is then lowered into the water, and upon reaching the bottom the strain upon the line ceases, and the arms fall down, allowing the ball to detatch itself entirely from the rod, which is then easily drawn in,—the drilled portion of which is discovered to be filled with a specimen of that which it has come in contact with at the bottom." With this apparatus, aided by the hosts of assistants whom Lieut. Maury's visit to Europe will doubtless bring to the great work of exploration, the ocean bed may become in time as well known to us as the bed of the Thames or that of the Hudson.

NEW DIBBLING MACHINE.—Mr. Thomas Revis, of Stockwell, has just specified, under Letters Patent granted to him, for "improved single-seed drilling or dibbling machinery." In this specification, he sets forth the following description of his apparatus, which has been tried, and found to effect the desired object so well that single grains of wheat have been deposited in the ground, and produced giant straw, and ears corresponding thereto both in number and size:—My invention consists in, or has reference to, improved drilling or dibbling machinery for planting seed singly, or one at a time. The droppers for dropping the seed singly are made to act by means of a lever, or lifter, having its head, or handle, near to the handle of the dibble, and by this means the mouth of the droppers will be opened just wide enough to deposit a single seed, whilst by this arrangement of the handles, the operator can hold and work the dibbler with the same

hand, which will enable him to use two dibblers at one and the same time—that is, one in each hand. In this case, the lever, or lifter, aforesaid acts by suitable mechanism, so as to allow only a single seed to issue from the mouth of the dibbler at one time; the tubes of the dibblers are to be made in parts, attached together as hereafter set forth; the funnel, or reservoir, designed to hold the seed being on the top of the tube. The two irons, or handles, called the lifting and holding-irons, are secured to the tube, and extend and pass through the top of the funnel. The tubes being made in halves, I have two pieces of metal (or other suitable material), one for each half of the tube, of a shape corresponding with the size of the inner circle of the tube; these pieces of metal are placed exactly opposite each other in the tube, flush with the top of it, and secured firmly to the tube; the piece intended for the side of the lifting-iron is designated the "receiver," and has a cavity formed thereon to receive the seed, and this cavity thus formed is left very smooth; the other piece of metal should be placed exactly opposite, in the other half tube of the holding-iron, and which is denominated the "strike," as it performs the office of keeping back the overplus seed on the return of the lifting-iron. It should be borne in mind, that in most cases of single deposits the seed should be sifted, that as uniform a size as possible may be obtained. In the case of wheat-sowing, or planting, I prefer to make the cavity of an oblong shape, and somewhat larger or deepened at the bottom, in order to adapt it to the shape of the grain. It is obvious the above-described mechanism may be adapted (a number combined together) to machine drills.—*Mining Gazette.*

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—October, 1853.
Latitude 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21 *min. West. Elevation above Lake Ontario :* 108 *feet.*

Magnet.	Day.	Barom. at tem. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of the air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	M'N V	Rain in Inch.	S'w in Inch.
						°	°	°	°												Miles		
c	1	29.512	29.446	29.374	29.443	46 5	58.2	53.9	52.80	0.240	0.264	0 374	0.238	77	55	91	74	N b E	S	S	3.04	0.085	..
a	2	.456	.539			46.5	49.2			.263	.221			84	64			N W b W	N W b N		6.33	- -	..
b	3	.662	.597	.664	.649	34.7	49.7	42.5	42 85	.170	.131	.236	.184	85	37	93	70	N W b W	W b N	W S W	3.79	Inap	..
b	4	.531	.397	.276	.390	47.8	64.7	57.7	57 07	.241	.343	.349	.313	73	57	75	68	S S W	S S W	S b W	8.29	0 150	..
b	5	.041	.019	.259	.115	55.8	57.1	48.7	53.20	.355	.351	.274	.326	81	77	81	82	S b W	W b N	W N W	9.11	0 215	..
b	6	.564	.673	.743	.687	41.2	45.6	32.1	39.48	.197	.174	.151	.171	76	57	83	71	N W b W	N W	W b N	5 60	Inap	..
b	7	.875	.793	.696	.786	24.7	49.5	43.8	41.63	.127	.217	.243	.207	80	71	86	77	N W	S S E	Calm	3 70	- -	..
c	8	.652	.423	.270	.428	35.5	58.6	56.1	51.55	.192	.331	.357	.290	93	68	81	81	Calm	S b E	S b W	4.73	- -	..
b	9	.373	.205			42.7	61.7			.242	.275			90	51			Calm	W b S		6.33	- -	..
b	10	.411	.430	.613	.519	33.4	46.6	37.3	38.80	.157	.198	.177	.166	82	63	80	71	W	S b W	N W	5 22	0.050	..
a	11	.790	.826	.870	.834	34.6	48.3	33.7	39.12	.164	.172	.162	.165	82	51	83	71	N W	N W b N	W	5 65	- -	..
b	12	.836	.773	.752	.779	36.3	52.1	39.5	42 07	.169	.188	.176	.175	79	49	73	67	W b N	W b N	W b N	4.29	- -	..
b	13	.762	.732	.798	.763	34.8	56.4	41.0	44.70	.162	.195	.195	.18[illegible]	78	43	76	66	W b S	N W	N N W	6.23	- -	..
d	14	.871	.892	.929	.906	36.4	54.7	40.0	43.58	.183	.206	.163	.200	87	49	66	71	N W b N	S b W	N	3.61	- -	..
c	15	.968	.907	.890	.917	34.8	56.5	43.5	44.83	.168	.270	.196	.216	84	61	70	73	N W b W	S	S b W	2.93	- -	..
c	16	.915	.910			34.1	57.4			.158	.326			79	71			S b W	S E		1.14	- -	..
b	17	.790	.763	.867	.809	41.6	60.7	48.0	50.45	.224	.334	.215	.269	86	64	65	73	N b E	S	N	3 80	- -	..
c	18	.941	.951	.933	.944	39.3	50.9	34.4	42.00	.196	.227	.156	.189	82	62	73	71	N	S S E	Calm	2.18	- -	..
b	19	.930	.901	.891	.912	31.8	58.2	43 5	44.80	.145	.251	.198	.211	81	55	71	70	Calm	S	Calm	0.79	- -	..
a	20	.864	.796	.705	.788	39.1	58.6	48 7	49.00	.205	.278	.215	.223	87	57	63	66	Calm	S E b E	N N E	1.25	- -	..
b	21	.607	.458	.305	.444	50.6	55 9	[illegible]	54 07	.322	.365	.395	.364	89	84	92	89	Calm	N E b E	E N E	7.60	0 005	..
a	22	.130	.093	.201	.166	57.4	57.9	53.5	55.55	.423	.387	.336	.374	92	82	84	86	N E b E	S b W	S W b S	7 45	0.020	..
e	23	.434	.482			38.4	48 4			.180	.260			78	78			S W b W	W b S		6 55	Inap	..
e	24	.667	.625	.429	.542	23.7	39.0	31.1	32.95	.143	.169	.128	.152	90	72	73	80	W S W	N N E	W b N	2 42	- -	..
e	25	.342	.513	.680	.525	25 5	38.1	34.5	32.70	.107	.155	.171	.142	76	68	87	76	W	S W b W	Calm	7.23	- -	Inap
b	26	.692	.589	.474	.578	37.3	46.5	43.8	43.10	.193	.230	.255	.238	87	74	91	86	S	S b W	S S E	5 53	0 350	..
b	27	.451	.537	.652	.570	44.2	48.3	39 5	44.32	.268	.239	.213	.235	93	72	88	82	Calm	N	Calm	5.53	- -	..
a	28	.658	.719	.816	.742	37.0	43.8	33.0	38.32	.182	.143	.152	.159	83	51	87	70	N E b N	N	N N W	3 53	- -	..
a	29	.956	.992	30.061	30.014	35 2	41.9	30.2	34.93	.167	.189	.132	.156	82	72	78	76	N W b N	S b W	N b E	3.18	- -	..
d	30	30.049	29 920			30.2	43.8			.145	.197			86	70			N N E	S E b E		2 31	- -	Inap
b	31	29.752	.618	29.526	29.623	28.7	50.1	44.5	41.40	.146	.216	.245	.206	93	61	85	80	E N E	S	S	7.14	- -	..
	M	29.664	29 633	29.643	29.649	38.34	51.84	42.70	44.40	0 202	0.241	0.226	0.223	84	62	80	75	Ml's 3.45	Ml's 7.55	Ml's 5 95	4.72	0 875	

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North, 1162.29; West, 1731.38; South, 1217.07; East, 402.64.
Mean direction of the wind, West.
Mean velocity of the wind - - 4.72 miles per hour.
Maximum velocity- - - - - 17.1 miles per hour, from 9 to 10 a.m. on 25th
Most windy day - - - - - 5th: Mean velocity, 9.11 miles per hour.
Least windy day - - - - - 19th Mean velocity, 0.79 ditto.
Raining 23 5 hours on 10 days.
Thunderstorm on 5th, from 11 A. M. to Noon.
Snowing on 2 days. Snowing 3 hours, quantity Inapp.
First frost of the season, 12th Sept. First snow of the season, 25th Oct.
Indian Summer from 12th to 20th October.
Highest Barometer - - 30.066, at Midnight on 29th. } Monthly range:
Lowest Barometer - - 28.985, at Noon on 5th. } 1.081 inches.
Highest regist'd Temp. - 64.7, at 2 P.M., on 4th } Monthly range.
Lowest regist'd Temp. - 23.4, at — A.M., on 30th } 41.3
Mean Maximum Thermometer - - - 53 34 } Mean daily range:
Mean Minimum Thermometer - - - - - 32 83 } 20.51
Greatest daily range - - - - - 31.5 from P. M. 9th to A. M. of 10th.
Warmest day - - 4th - - - Mean Temperature - 57.07 } Difference
Coldest day - - - 25th - - - Mean Temperature - 32.70 } 24.37

The "Means" are derived from six observations daily, viz., at 6 and 8 A. M., and 2, 4, 10 and 12, P. M.

Aurora observed on 4 nights. Possible to see Aurora on 16 nights. Impossible to see Aurora on 11 nights.

The column headed "Magnet" is an attempt to distinguish the character of each day, as regards the frequency or extent of the fluctuations of the Magnetic declination, indicated by the self-registering instruments at Toronto. The classification is, to some extent, arbitrary, and may require future modification, but has been found tolerably definite as far as applied. It is as follows:

(*a*) A marked absence of Magnetical disturbance.
(*b*) Unimportant movements, not to be called disturbance.
(*c*) Marked disturbance—whether shewn by frequency or amount of deviation from the normal curve—but of no great importance.
(*d*) A greater degree of disturbance—but not of long continuance.
(*e*) Considerable disturbance—lasting more or less the whole day.
(*f*) A Magnetical disturbance of the first class.

The day is reckoned from noon to noon. If two letters are placed, the first applies to the earlier, the latter to the later part of the trace. Although the Declination is particularly referred to, it rarely happens that the same terms are not applicable to the changes of the Horizontal Force also.

Comparative Table for October.

Year.	Temperature. Mean.	Max. obs'rvd	Min. obs'rvd	Range.	Rain. D'ys	Inches.	Snow. Dy's	Inch	Wind Force. Velocity
	°	°	°	°					Miles.
1840	44.4	68.5	23.9	44.6	13	1.860	3	not	-
1841	41.6	58.3	20.3	38.0	6	1.360	2	rec'd	-
1842	45 1	68.5	30.0	38 5	8	5.175	0	"	-
1843	41.8	65.7	24 5	41 2	12	3.790	4	2 5	0.54lb.
1844	43.3	69.6	17.8	51.8	7	imperfect	4	12·0	0.43lb.
1845	46.4	62.7	20.0	42 7	11	1.760	1	Inap.	0.36lb.
1846	44.6	69.7	20.7	49.0	14	4.180	2	Inap.	0.44lb.
1847	44.0	65.0	20.3	44.7	13	4.390	2	Inap.	0.13lb.
1848	46 3	62.2	26.4	35.8	11	1 .550	0	none.	4 60m.
1849	45.3	59 2	25.5	33.7	13	5 965	1	Inap.	4.76m.
1850	45 4	66.6	24.8	41.8	10	2 085	0	none.	5.30m.
1851	47.4	66.1	25 0	41.1	10	1.680	2	0 3	4 39m.
1852	48.0	70.7	29.8	40.9	12	5.280	0	none.	4.47m.
1853	44.4	64.7	25.5	39 2	10	0.875	2	Inap.	4 72m.
Mean	44 86	65.53	23.89	41.64	10.7	3.073	1.6	1.3	0.37 lb. 4.71 M.

The Canadian Journal.

TORONTO, DECEMBER, 1853.

Toronto Harbour—Its Formation and Preservation.

Read before the Canadian Institute, June 1st, 1850;

BY SANDFORD FLEMING, C. E.

The origin of the now wealthy and flourishing city of Toronto is, in common with that of many other cities and towns, clearly traceable to certain natural advantages possessed by their localities. A waterfall or rapid stream, the navigable termination of a river, or its junction with a lake, or other open navigation, will frequently account for the position of a town or village in an agricultural or manufacturing district; but a natural harbour of easy access, will generally if not universally point out the locality of a thriving commercial nucleus, in all countries open to settlement and civilization.

To none of these circumstances except the last can we attribute the origin of Toronto. We have no waterfall—no navigable river—even the soil itself is comparatively barren, and for several miles around, with a few isolated exceptions, unsuited for agricultural purposes. To the last, therefore, must we ascribe the beginning of Toronto, and to the unequalled excellence of this harbour forming on the north shore of Lake Ontario, the most facile outlet for the productions of the back country, is principally due the rapid and uninterrupted progress in commerce and in wealth of the western capital. To maintain this harbour in its original state, or if parcticable, to improve thereon so as to ensure a continuance of prosperity, becomes, therefore, of the utmost importance.

The natural basin formed by a sandridge extending from the western boundary of the township of Scarborough, embracing in its arms a portion of the great lake, possesses many of the requisites for a good harbour; it encloses about 1200 acres of water, entirely free from rocks and shallows, and averaging from 15 to 35 feet in depth, on the wide expanse of which the whole shipping of *all* the Canadian lakes might safely ride at anchor. During the prevalence of certain winds, however, the basin is not of easy access to sailing craft; and not only is the channel scarcely sufficient to admit the entrance or departure of large vessels, but it is even fast closing up, and, astounding as the assertion may appear to some, will ere many years, unless efficient means of prevention be taken, put a complete stop to all navigation—a bold enough statement, but from ascertained facts a proper inference.

That the entrance to the harbour is fast closing up, I have been led to discover, by comparing a series of careful measurements recently made, with old charts of various dates. In the sequel, this important fact will be clearly shown, and an attempt made to account for it; in the meantime, it may be sufficient to state that a bar has encroached so much on the channel, as to make it not more than about half the width it was fifteen years ago. With the view of prescribing an efficient mode to prevent the further accumulation of shoal calculated to prove so detrimental to the future prosperity of the city, it is first requisite to ascertain the cause of the evil, from whence it arises, and investigate the manner of its action—hence the following enquiry into the formation of the Peninsula and Harbour.

Few persons visiting Toronto for the first time but are struck with the singular appearance of the neck of land or peninsula

stretching out into the lake in front of the town, so low, that the few small trees growing at wide intervals appear almost springing from the water, and on a nearer approach, so long, so curiously shaped, and so different from the land on shore, that, many are doubtless led to theorize a little on its formation. Some, who have probably arrived in the province by way of Niagara, and crossed over with their minds filled with contemplations of the mighty cataract, at once and without much consideration attribute to the descending torrents of that river, the power of elevating from the depths of the lake, or of carrying across in suspension, the drift deposited here—a theory wild and incapable of defence, though some are bold enough to venture it.

Others again, who have probably arrived from the west, or whose business takes them frequently in that direction, and from the steamer generally calling at the mouths of the various small rivers emptying into the lake between this and Hamilton, may be induced to think that these streams have had the effect of drifting the debris of the uplands outward, which with the assistance of an imaginary eastward current of the lake, is carried until meeting a contrary current, supposed to be of the Don, then the matter held in suspension is supposed to have been deposited at their junction line, opposite Toronto. The advocates of this theory have yet to prove that such currents of the lake as these exist in reality: although it is true that currents outward and inward, over the bar, are found, occasionally resembling a slight half-hourly tide; yet if they have any effect on the bar at all, they must have a tendency rather to diminish than increase the deposit. All these streams with the exception of the Don, enter the lake nearly at right angles, and it is impossible that they can flow into a large and deep body of water such as exists between their mouths and the point in question, without being entirely diffused; nor could the drift brought down by them be carried wholly or chiefly in one particular direction without a most powerful current, but would, if ponderous, be deposited at their outlet, and if light, would be distributed far and wide. More especially is it reasonable to infer that the Peninsula is neither now effected in any way by these western streams and the imaginary currents in conjunction with them, nor *has* been formed by their drift, since the material composing it, sand and gravel could not in accordance with existing laws, be held in suspension and transported for miles over still water, 60 and 100 feet deep. Were the deposit or any part of it of an agillaceous nature, there would have been some slight reason to think that these streams might have been auxiliaries, but such is not the case.

Others again suppose that the Peninsula is merely a narrow ledge of rock slightly covered with the sand and gravel which we find on the surface, but this opinion is quite at variance with the general geological features of this part of the country, and to local investigations.

A little consideration of the subject will shew that these opinions can only be advanced by those persons who have merely been enabled to make cursory observations, and by those who, knowing the wonderful transporting power of running water when confined, as in a river, are inclined to attribute to its agency more than is justly due, and overlooking the change of circumstances, class effects universally which can only be prouced by causes under particular conditions. They being anxious to account for certain results, are contented with a superficial and fallacious reasoning, and assign to the most conspicuous agents of nature, that, which after a more careful and deeper search would be ascribed to a power less easily observed, but not less active, or less potent.

Sir Richard Bonnycastle, in an elaborately drawn up Report

dated 1835, gives it as his opinion that the Peninsula "was one of the many ridges deposited at the bottom of a vast lake which existed before the present Ontario and Erie were formed out of its drainage," and "that it had not materially altered for a vast length of time, probably not since it emerged from the waters."

It may be thought presumptuous in me to present anything in opposition to the judgment of that respected and eminent gentleman; but from careful observations and measurements, and a comparison of these with surveys made at different times by others during the last half century, having found that the deposit both above and under water has received additions so extensive, and which so closely resemble in character its older portions, I may be permitted to suggest, instead of the Peninsula being a sedimentary deposition of the tertiary periods, as thought by Sir R. Bonnycastle, that the whole of it belongs to the present era, and that at least one of the agents of its formation, is at this day as actively engaged in changing and enlarging the outline of the deposit in question, as it has been hitherto in gathering together the materials, and modelling them into its present shape.

I shall first endeavour to show that the inferior portion or base of the Peninsula has been washed from the valley of the Don by that river at an early date; second, that the materials composing the superior and more recently formed portions have been gradually transported along the shore from the eastward, and that this westward progressive motion of the sand and gravel beach is now the sole cause of the extension and enlargement of the Peninsula, and of the danger at present threatening the entrance of the Harbour.

First—That the groundwork of the Peninsula enclosing the Harbour is, or has been, a delta of the River Don.

It is generally believed that at one time Lake Ontario stood at a higher level, and covered a far greater area than it at present occupies. A barrier may have then existed at its outlet, where probably the Thousand Islands are now seen, over the top of which the primæval St. Lawrence flowed; this great river, rushing over the barrier with tremendous velocity, would, through course of time, wash away its softer parts, and leave standing those numerous isolated rocks and picturesque islands which now covered with foliage, adorn so much the landscape of that section of the country. If this be not the approved way of accounting for the lowering of the level of the waters, a gradual upheaval of the land generally, or even a subsidence of the ocean may be brought forward; it is unnecessary for our present purpose however to enter into a geological disquisition on this point, if we allow that the whole of the country bordering on Lake Ontario was at one time submerged under the same extensive sheet of water; and that the level of this great lake, or it may be this arm of the ocean, was through course of time depressed, and its outline contracted until it was reduced to the present Ontario. A supposition so strongly supported by the discovery of several ancient beach lines, terraces and parallel ridges in the vicinity of Toronto and other parts of the country at various but corresponding levels, that it may without much difficulty be admitted.

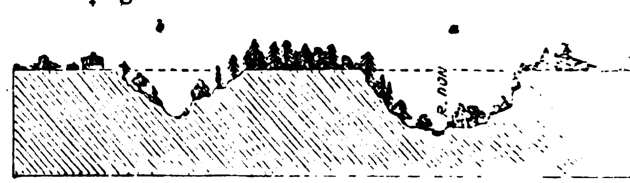
As the land gradually emerged its appearance would be bleak in the extreme; a flat or but slightly undulating surface unbroken by rivers or ravines, and uncovered for a length of time with vegetation; on the ancient shallows of the great lake various kinds of plants would, through course of time, take root, grow up, and wither; the continued reproduction and decay of which would gradually coat the surface with organic matter, and thus enriching the soil, enable it to produce more luxuriant vegetation. Now, (prior to the settlement of the country,) after a lapse of many centuries, we find the great hardwood forest growing over soils of an argillaceous character, and the ancient *sand shoals* of the great lake clothed with lofty pine.

We can easily imagine the general character of the present shores of Lake Ontario when they first became dry land—a vast undulating plane ascending as at present from the lake into the interior, but totally devoid of water channels for the surface drainage—here a bed of clay,—there a tract of sandy soil; and as it is only reasonable to suppose that rains fell in those days as at present, the water produced by them on the surface, in flowing from a higher to a lower level, would most easily wash out channels in the softest material; and these little streams, collecting together in their downward course towards the lake, would form the commencement of a river course.

The newly formed rivers, having the same fall towards the lake as the surface itself, their beds being but slightly under it, would be much more rapid than they are now, and rushing down with violence after thaws and heavy rains, would, proportionally with their greater rapidity, during the first years of their existence, be more effective in scooping out the sand drift and transporting it to the Lake; from year to year the water channels would thus grow larger and larger, and although the rivers as they were depressed, lost much of their force and rapidity, yet continually undermining the banks and transporting the debris downwards, would, through course of ages, form those deep ravines in which many of them now flow.

That the rivers in this section of the country have originated in this manner, is inferred from the fact, that they are found almost universally to flow in flat-bottomed vallies or ravines, the banks of which are the abrupt terminations of the level country on each side; and that these ravines are generally found where the drift is of a light and sandy nature.

The accompanying section across the River Don, taken a little above the Cemetery, will show clearly the first proposition; the second also is established by the well-known character of the soil of which the banks are composed. The surface of the country extends for miles to the right and left of the river without any material change of level, except where broken by a secondary ravine of a tributary stream. Doubtless, then, the inference is correct as far as regards the Don, and that the dotted line stretching from bank to bank on the drawing, was the surface prior to the scooping out of its channel.



Section across the Don about 1½ miles from its mouth.

a. The valley of the Don about ¼ of a mile wide, and upwards of 100 feet deep—the river here is on a level with Lake Ontario.

b. A tributary of the Don, running through Yorkville, it is cut obliquely by the section and forms a junction with the Don about ½ a mile further down.

The dotted line is about 120 feet higher than the lake, and the surface maintains very nearly the same level for a long distance on either side in a direction parallel to the shore, with a gentle slope at right angles to it—on part of this slope the City of Toronto is built.

Nor is the Don singular in these respects, of all the streams I am acquainted with to the east and west of Toronto, the same scooping out of the ravines can be shown, and generally the same sandy character of the country immediately traversed, as indicated by the dark green belts of pine running into the interior of the country through the hardwood forest which flourishes better on

the heavier soils. And here, without digressing much from the subject, one can scarcely avoid observing very apparent marks of design—the adapting of the pine to grow on soils unfitted for cultivation, and the leading of rivers through pine-bearing soils, thus enabling the settler to take advantage of the various properties of running water in conveying and preparing the most useful of all timbers for his manifold purposes.

The valley of the Don is from a quarter to half a mile in width, with abruptly rising banks, from 100 to 200 feet and upwards in height, the scooping out of which implies the removal of many hundred millions of cubic yards, a quantity so immeasurably great when brought into comparison with the agent of removal—a stream (when not dammed up) only about 50 feet wide, that it appears altogether irreconcilable with the inference drawn; more especially is it so, when we know that the annual quantity of matter brought down by the Don is at present inconsiderable. If, however, we bear in mind that, without assuming a greater volume of water to have flowed in its channel than now, the transporting power of the Don must formerly been very much greater by reason of its greater descent and rapidity; and, if it can be shown that many ages have elapsed since it first came into existence, the conclusion come to may be taken as rational and correct.

It may seem difficult—nay, almost impossible—to estimate, however roughly, the time which has elapsed since the Don commenced to flow; but if we can arrive at the age of any other river emptying its water into Lake Ontario from a source equally high, the problem is solved. When the great Lake already mentioned, subsided from its high level, then, and not till then, did the Niagara, the Don, and other cotemporary rivers make their appearance. Since that epoch the Niagara has cut a deep channel for seven miles through the solid rock; its annual recession has been ascertained approximately, and from these data its age has been roughly determined. "We may turn to the deep ravine," says Lyell, "and behold therein a chronometer measuring rudely, yet emphatically, the vast magnitude of the interval of years which separate the present time from the epoch when the Niagara flowed at a higher level."

Thus, then, the Don, coeval with the Niagara, has flowed, according to this great Geologist, for a period far too great for the imagination to comprehend, and which one can scarcely venture to name by years; *even allowing that our historical knowledge of the past condition of the Falls is far too meagre to estimate with any degree of precision, the rate of their retrogression in former ages, yet we cannot but arrive at the conclusion that the chronological age of the Niagara and consequently of the Don, must be so enormously great, that one would think even its fractional part would suffice for the removal of the hundreds of millions of yards of matter by the latter river to the Lake, without calling to its aid any unusual phenomena.

Having thus shown that sufficient time may be granted, the Don therefore supplies an adequate cause for performing, and completing long since the work assigned to it; year after year during its early history, slowly but constantly hollowing out a channel and removing the former contents of its valley to the lake, the lighter and more soluble matter being held for some time by the water, to be distributed far and wide, the heavier particles on the other hand to be deposited near its mouth, in the form of an extensive shoal or delta—the base or ground-work of the Peninsula, on which again to be deposited a drift from other causes and from another source.

To be continued.

On the Preservation of Food.

BY J. T. BRONDGEEST, ESQ.

Read before the Canadian Institute, December 10, 1853.

Interesting in an economical point of view, this subject becomes much more so when we consider how large a portion of the exports of Canada consist of provisions, and the shipments from Toronto of little else.

This has been the subject of care in other countries, and in distant ages, when either from want of skill, or the accidents of war, famine was more prevalent than in modern times, and in those places with which we are the more familiar; the freedom of intercourse now renders the surplus of one country so accessible to supply the wants of another, that the deficiency of crops must be far more general than any that has occurred for years, before we require any particular arrangement, for preserving the products of the soil from one year to another.

But let not this fancied security prevent us from examining into the matter closely, for, apart from the possibility of the wheat-fly devastating other parts of the world in the way Lower Canada suffered for many years—let us not forget that constant waste is a constant loss, without any countervailing benefit, and that we agitated for years for a grant from the Mother Country for a protection on our breadstuffs, falling far short in amount of the loss occurring in our grain stores from destruction by rats and mice alone. And in forwarding grain to its destination, much as it has been improved upon of late years, there is still in every portion of the process loss and injury.

I propose, therefore, to give my views on the subject of the preservation of articles of food, premising that I offer nothing new, having often previously on other occasions urged the matter on the attention of my fellow-citizens, and also intimating my anxious desire that my remarks may call forth something much better than what I now offer to your notice.

Our warehouses for wheat are mostly constructed near the water, often so low as to be in danger from floods; they are built of wood, many of them in bad order, subject to destruction from fire, and infested with vermin.

Owing to the short time our grain remains in the warehouse, the weevil, so destructive in Europe is little known, were it necessary to store grain for any lengthened period, there is little doubt the destruction with us would be excessive, our granaries being so accessible to heat.

I would propose as a remedy for all these, the construction of "silos"—warehouses built of brick in the form of a hollow cone, like a tile-kiln, cemented outside to keep out the weather, having an iron cover on the top, and an opening at the lower portion to let out the grain—the grain is put in at the top, either by an Archimedian screw or by a crane, and taken out below as required; and as the grain is moved throughout the whole mass whenever any is removed from beneath, to air the grain nothing further is required than to take some out below, and put it back again at the top.

These buildings were used in ancient times, and are still used

* "Mr. Bakewell calculated that, in the forty years preceding 1830, the Niagara had been going back at the rate of about a yard annually, but I conceive that one foot per year would be a much more probable conjecture, in which case 35 000 years would have been required for the retreat of the Falls, from the escarpment of Queenston to their present site, if we could assume that the retrograde movement had been uniform throughout. This however, could not have been the case, as at every step in the process of excavation, the height of the precipice, the hardness of the materials at its base, and the quantity of fallen matter to be removed, must have varied. At some points it may have receded much faster than at present, at other much slower, and it would be scarcely possible to decide whether its average progress has been more or less rapid than now."—*Lyell.*

in India; they would cost little to construct, and would be proof against vermin, fire and mildew, and last for an indefinite period.

The shipment of grain is also defective and wasteful. The putting the grain into a vessel in bulk, carrying it from the granary in bags, the transhipment by taking it out in bags and carting them some distance to the vessel intended to take the grain to its trans-Atlantic destination, again shipping in bulk, and on its arrival being taken out again with bags, with the rattage at every point of its progress, the spilling every time it is moved, and deterioration in quality from constant exposure, cause an amount of loss that, were it carefully estimated, would lead to an utter change in the methods employed in sending it forward.

Grain should always, on removal from granary, be put into barrels. These might be made of sawed wood, (seasoned or steamed of course,) which barrels would sell in Britain at a profit on cost for cooper's use. They should hold four bushels Imperial, or half a quarter, and in addition to shipping marks, have quantity and quality painted on them. As no vessel can take a bulk cargo of grain in greater quantity than in barrels, owing to the weight, the freight would not be augmented in consequence. Indeed, from the freight being what is technically called "rolling freight, it would most probably be somewhat less, and all loss from spilling, damp, heating on the voyage (the spaces between the barrels allowing of free circulation of air,) would be prevented, the damage from rattage much lessened, the shipment, transhipment and landing very much facilitated, the qualities of wheat and the properties of the various shippers kept quite distinct, and the sale, being in precise quantities, much facilitated.

Were our grain trade what it was ten years since, the present system might be tolerated some time longer, but in the view of the rapid increase of our grain trade, some means, whether they be such as I have pointed out, or better, should be employed to prevent the destruction of a large portion of our produce. I need not point out the superiority of barrels for the packing of grain, if to be transported by railway—a mode of conveyance we must very shortly accustom ourselves to consider.

The improvements made of late in the manufacture of flour, and the increased facilities for its transmission to the places of consumption, much to be improved by the formation of a regular line of iron steamers from Montreal to Britain, (steam ensuring rapidity, and the conducting powers of iron ensuring coolness,) would leave me little to say, were it not that the constant quotation of Canadian sour flour proves that it often spoils on the voyage, and that for the Californian and Australian markets, or indeed for those of the British West Indies, it is altogether out of the question, as Baltimore or Charleston American flour, or even that manufactured in Hamburg, in Europe, has to be taken in place of Canadian, at a higher price.

Nor does the evil end here, for owing to the necessity of preparing flour to keep, the highly nutritive spring wheat has to be rejected, and the gluten of the winter wheat cannot be made use of to the fullest extent, this gluten being the most valuable portion of the grain.

On the other hand, if Canadian flour could be made to keep, and could, by regrinding the whole of the gluten be used, and a portion of spring wheat employed to give strength, Canadian flour, from its superior strength, would sell at a higher price than any other whatever.

The remedy, the sole remedy, is the employment of the kiln—not to the wheat, for that renders it too hard to grind, and too dark in colour, (some of the best spring grain, indeed, requiring to be wetted to grind well,)—but the *kiln* employed to dry the *flour*.

Now, steam heat offers the readiest mode of drying, either employed in a metallic chest, or enclosed in a tube round which a screw might be constructed, to convey the flour to the cooling rooms, and thus be submitted to the heat of the steam while on its passage, and every particle exposed to the heat in turn.

All the trouble and anxiety now felt by shippers, apart from the fluctuation of markets would thus be obviated, our spring wheat could be used freely, and a fair price paid for it, now almost rejected altogether, and the whole of the grain excepting the mere cuticle, or bran employed, increasing the price of our flour 15 per cent., and the quantity at least as much as would be lost by the shrinkage by drying, while the enterprising might seek other and more distant markets, probably also far more profitable ones, than those of the United States and Great Britain, to which we are now confined by the perishable character of our flour.

While on this subject, I may be excused adverting to the fact that wheat alone is made into flour properly so called, barley being merely husked or ground into small balls, peas husked or as commonly called "split," rice simply pulled, while oats and corn are highly dried and then coarsely ground into meal. Now all these articles, with the addition to the list of rice and white beans, would make flour, useful to some extent for bread, serving as a variety and very important at sea, but also for soup and puddings, far more available than the preparations now employed. Indeed it would at first sight seem more rational to grind wheat into meal, and the coarser grains into flour, than the present practice—probably custom is the sole cause. For all these species of flour the kiln is even more requisite than for wheaten flour, the grain being ground undried.

And before dismissing the subject, I may also advert to the change of late in our acquaintance with the nutritive qualities of various kinds of Grain. At one time, because Wheat proved to be highly nutritive, and contained gluten as well as starch, and starch was clearly proved incapable of producing muscle, gluten was considered the nutritive principle; but as Maize supported life equally well, and contained zein in place of gluten, zein although differing from gluten in many respects, had to be considered its equivalent as food, and so with hordein in Barley, vegetable casein in Beans and Pears; and lastly, Rice, which at one time was coolly put down as quite innutritious, although some three hundred millions live chiefly on it, is now looked upon as scarcely behind the rest, Oats having been all along thought to possess nutritive powers possessing gluten, or something not far from it.

The fact being that the life sustaining qualities are much alike, and although some possess sufficient compounds of nitrogen to form muscle, and enough compounds of carbon for fat and for warmth, some, it is true, contain more of the various phosphates than others, and differ in other ways,—that very difference proving their utility,—and that as a variety of animal and vegetable food conduces to health, we should be all the better if our bread was more diversified in character.

I digress once more to speak of a subject having much relation to the preservation of flour, namely, its preparation from grain by grinding; for the purpose of making flour of a keeping quality, extra coolers have been employed for a long time, well seasoned barrels are deemed a most important item, if they cannot be obtained air seasoned, steam dried staves answer perfectly, even if made of wood cut the day previously; planes are manufactured in London of Beech wood cut a few days previously, but prepared by steaming.

Various patents have also been taken out—Bovills, employed by J. B. Ewart, Esq., Dundas, blows air through the eye of the stone, cooling of the flour, and helping the centrifugal force, to expe

the flour before being ground too low—Bonnell's patent—patented at Detroit, although Bonnell is a native of Toronto—being an improvement upon the celebrated French mode of grinding mouture economique, now so much admired in England, and consisting of grinding the wheat in the first place, very coarse, or high, as it is called by the miller, and then regrinding the flour that will not pass the bolt by means of very small stones revolving at a high velocity—thus securing the whole nutritive qualities of the wheat in a condition highly favorable for making bread, but as I fear containing too much gluten to keep for any length of time without the kiln; and lastly a patent taken out in England for grinding with conical stones, fitting one over the other, grinding, at a high velocity, and discharging the flour before it can become injuriously heated, securing also, like Bonnell's, all the nutritive qualities of the grain,—this I think, will be found to answer partially without the kiln, much better with.

Strange that the mill remaining in the bakery still existing at Pompeii, should be a conical mill—how often our new inventions are but reproductions of forgotten arts.

The failure of the potatoe crop, or rather the failure of the means taken to preserve the potatoe from one season to another, has been the cause of much anxiety, and various means suggested and tried to remedy the evil with various success.

But it has generally been forgotten that at all periods, even when the potatoe was as a plant the most vigorous, and its culture the most certain, there was a portion of the year when the old potatoe lost much of nutritive powers, all its flavor, and even contained a positive poison, (solanine) while the new potatoe was equally valueless as food. And also that at sea in long voyages the supply of potatoes became so deteriorated as to be of little use.

When Napoleon the First sent his armies through Holland, potatoes were prepared for their use in a way it certainly would be easy to imitate. After being well washed, they were steamed for a moment or two, to loosen their skins, which were then rubbed off, when the potatoes were put into an Iron Cylinder with holes at the bottom, and forced through by a piston in a state resembling macaroni. These pieces were then dried at a heat sufficient to accomplish the object, but insufficient to cook them or alter the flavor, the potatoes could then be easily transported, and could at any time be made into mashed potatoe. It would keep any length of time, retaining all the original qualities of the recent tuber.

Some such process has been lately employed in Britain in preparing the root for use at sea, whether the same or not, I cannot say,—the one I propose could hardly be improved upon, and would enable us to enjoy an article of food as popular as the one in question, in full perfection all the year through, besides allowing us to draw our supplies from a distance, and giving us an additional article of export to the West Indies where in spite of the Yam, the Banana, the Casava, and the Sweet Potatoe, the ordinary potatoe is much valued.

In the same manner carrots, parsnips and turnips might be prepared, I have seen French preparations of these roots as fine as flour. Unripe peas can either be dried whole or in flour in either shape, agreeable at sea or in winter.

Onions can be preserved with little injury in brine, cabbages put up with insufficient salt to prevent fermentation, produce the German dish sour-krout, but salted enough, will keep for a considerable time, the salt can be readily removed by soaking, the same can be done with French Beans, and most pot herbs.

The preserving vegetables in vinegar so completely alters their flavor and all other qualities, that I shall make no remark on the subject, further than to shew the singular importance of them in preventing Sea Scurvy, and that pickled cabbage forms a part of the sea stock of vessels going on long voyages. The necessity of *raw* vegetable food in some shape every few months, and that nothing cooked will answer to prevent Sea Scurvy, makes the putting up of pickles of more interest than we might at first consider, even if with our long periods of forced abstinence from fresh green food in Canada, the use of pickles were not probably highly important to the animal economy, instead of being thought merely an unhealthy indulgence.

I shall make less remark on the preserving fruits with sugar, as the cooking of them not only nearly destroys their flavor, but their utility as a preventative of Scurvy is lost also.

Far different in the mode of preserving them by excluding the air, now so much resorted to in Britain, and beginning to be appreciated by the ladies of Toronto.

This process, invented I believe, by Mr. Appert, a native of France, and applied to the preparation of most articles required at sea, consists simply in procuring an air-tight vessel, say of glass, to be closed by a cork waxed over, or of metal, soldered down, in which the article to be preserved has been placed, and covered with water, a small aperture then being made to allow of the escape of air, the water is made to boil by means of a water bath in which the vessel is placed, as soon as the air enclosed in the vessel, in the food to be preserved and in the water itself, has been driven off, which takes place in a short period of time, the small hole is closed up also, the vessel being removed from the Bath. In this way all matters requiring to be preserved may be put up to keep any length of time, whether fruit, fish, vegetables or meat, whether raw or dressed; for the the preparation by no means cooks the article, although with delicate fruits, it injures somewhat its appearance. In this way also, can be preserved cooked meats in any form, milk and cream, as well as solids. It is to be wished that in this way the domestic preparation of fruits and summer vegetables, as fresh peas, french beans, and asparagus, will become general, and supersede altogether, the preparations with sugar, and that before long, that Toronto so advantageously situated for the procuring of animal food, and shortly, by means of railways, to become still more so, will be known for the cheapness and goodness of its preserved provisions, fish, flesh, fowl, fruit and vegetables, that the great demand now felt for them for sea use, will be supplied from a place where they are good and abundant, and not have to be put up as in London, where the cost is threefold what it is with us, or as at Trieste, where the British Government made with the very celebrated Mr Goldner, a contract for provisions, which proved to be merely the refuse of the slaughter house, not preserved at all.

Were the cans made larger and of a cheaper material than tin, say galvinized iron, and the process more economically attended to, it is more than probable that provisions thus put up would form a valuable export, not only the West Indies, where all such things are in demand, but also in Great Britain, not merely for sea use, but for home consumption; the package and preparation would be probably cheaper than barrels and salt, as used in putting up salt provisions, and decidedly more popular.

The salting and packing of Butter has been much better attended to in Canada West, of late years, than heretofore, when our grazing farms are larger we may look for a still greater improvement; that is, when the farmer himself puts down his own butter, and can fill the package in a few days. The Store packed butter will always prove inferior; if not repacked, will be of various flavors and colors, and if repacked greasy.

To make butter keep, the whey should be entirely removed by washing with clear water, and salted with highly dried Li-

verpool Salt, one ounce to the pound of butter—Saltpetre is injurious, Sugar useless—the reason for using Liverpool Salt is to avoid the chlorides of magnesium and calcium, (muriates of lime and magnesia) so common in American Salt, which are bitter and tend to the decomposition, and dried to make it absorb any whey remaining after packing, brine should be put in to fill, a cloth soaked in pickle having been previously inserted at each end to prevent the butter adhering to the wood when opened, and to prevent the access of air through the pores of the wood.

The packing of salt provisions has been much improved of late years in Canada, but although the right method is well known it is not sufficiently adhered to, to cause the demand for them in Britian which we would desire, and the West Indian demand is in much the same position.

The great object in salting provisions is, to make them keep in all climates, and for at least three years if required, and not to become so salt as to lose their flavor and nutritive qualities.

To accomplish these ends, it is essential that a chemical change be made in the muscular fibre, so as to render it less porous, this is done by pure dry salt which, absorbs part of the water of composition, leaving the muscle much closer, and which closeness it retains, absorbing afterwards much less salt, although at the same time keeping better.

The liquid resulting from this dry salting, should be either thrown away, or if any object, boiled and skimmed as brine.

The meat should then be packed with coarse salt between every layer, as well as at the top and bottom, and finally filled up with Brine.

The salt should be dry Liverpool for first salting, coarse grain Turks Inland or St. Ubes for packing, so that it may, by dissolving slowly, keep the brine at full strength at every part of the barrel, and American Salt avoided, for the reasons adverted to when speaking of packing butter—chlorides other than that of sodium being bitter, spoiling the color of the meat, and tending to decompose the meat rather than preserve it.

Beef requires in the first preparation a very small quantity of Saltpetre to give it a red color, for every other end it is worse than useless, but custom absolutely requires it, for this one ounce to the 100 lbs. beef is enough. And to preserve Beef from being so salt as to be useless, unless it be exceedingly fat, molasses or sugar are absolutely required, one gallon to 200 lb of Beef put in when packed, is not too much, and for sea use might be doubled.

The drying of meat is practised in many countries to a great extent, in some even without salt, being cut into strips and dried in the air, called Charque, or pounded and dried as pemmecan, or as recently prepared in Texas, pounded fine and made into Biscuits, with flour enough to keep them together, and then slowly dried. Some modification of this last mode is no doubt, desirable for sea use, as affording the basis for soups and stews, it might, indeed, be dried after being chopped fine, and would then on being wetted, serve a variety of purposes. Milk dried has been found to possess all the qualities of new milk, on being dissolved in water, and eggs can be prepared in the same way; of course all their preparations require to be kept in packages, proof against the air and vermin.

Drying after salting is a very desirable and agreeable mode of prepartion, and although mostly applied to Pork, could be also extended to Beef, beyond the common Beef-hams, and also even to Mutton.

Smoking—by means of which a small quantity of creosote adds its flavor and preservative qualities to that of the salt is much used with Pork—and with some kinds of fish—it might be extended to beef, and sea provisions might consist of a much greater variety of preparations than is now usual. The Beef smoked at Hamburg is remarkably fine in flavor, but there is nothing with superior beef and good salt to prevent the Toronto article being equally so.

To the list of salted and smoked articles, sausages may be added, and most of our lake fish, especially Lake Huron Trout, White Fish, Pickerel, and Herring, which last, if well and carefully smoked would surpass the celebrated Yarmouth Bloaters.

Meat can also be preserved fresh in fat, Pork has been sent from America to England packed in Lard, and Beef Steaks sent from Glascow to Jamaica in Suet; but I do not believe it was ever sent to any extent, or under any but very favorable circumstances.

When the Railways are all completed however, it is quite possible, by their means, and shipping by the New Iron Packets from Portland, that Toronto could supply the London market with fresh beef, mutton, and poultry—at all events it would not be more singular than the regular supply of the New York Restaurateurs with English Game, as at present so commonly practised—or Scottish Salmon at a Toronto Railway Dinner.

Other modes of preserving, not yet carried into effect, suggest themselves, one consists in the use of Acetate of Alumina, a salt possessing little taste, but of considerable preservative powers, but whether this salt would exercise an injurious effect on the health if employed in preserving food, and thus taken into the system remains to be seen. Chlorine and Sodium enter into combination in forming many of the fluids of the animal economy.—Aluminum might be inert, or might be injurious, but could not like common salt be of service.

But one mode of preserving remains, which, although not confirmed by experiment, deserves careful trial, and I trust, ere long, will receive the attention it deserves,—and that is the preservation of food by immersion in Carbonic Acid Gas. This will offer many advantages over simple expulsion of the air, as boiling will not be required, and consequently the article preserved will be perfectly unaltered, no collapse will take place in the package if metal, no pressure if of glass, and the interior and exterior gases being in equilibrium, much less probability of a leak in the cork; whether any particular apparatus however, would be required, such as the withdrawal of the atmosphere air prior to the introduction of the gas is to be seen. I think a jet of gas under pressure would fill the vessel, and sufficiently drive out the air, while the superior specific gravity of the carbonic acid gas would retain it long enough to allow of the insertion of the cork and sealing. This method of preserving should be tried with peaches and tomatoes, or other pulpy fruits, with which, if successful, there could be no difficulty with other articles.

I have thus, gone through the subject of the preservation of food, as far as I am acquainted with it, chiefly with the view of calling attention to a matter of so great importance; if what I have said may lead to practical improvement, I shall be happy in having agitated the question, and much more shall I be contented, if I can lead others to suggest something better, as I believe that the interests of Canada, especially of Toronto, are so bound up with the trade in provisions, and that trade so identified with the ability to send them in proper condition to market, that a very slight improvement in the direction I have pointed out may be of incalculable advantage.

The Arctic Expeditions.*

We alluded last month to the publication in full of Capt. M'Clure's despatches:—and we return to them now in order to extract a few details of considerable importance, which are necessary to the elucidation of that officer's proceedings.

It will be remembered, that we expressed regret that the, so called, white man's grave, near Point Warren, was not examined. This omission is still to be deplored;—but it appears that Capt. M'Clure did delay his departure from the Point for several hours, for the purpose of examining a house which the Esquimaux told him had been built by the party of white men one of whom had been murdered. The result will be best related in Capt. M'Clure's own words:—"The interpreter, Dr. Armstrong, and myself went on shore in eager expectation of discovering some clue that would lead to a knowledge of the parties:—but in this we were miserably disappointed. Five huts, indeed, were there, to excite hopes; but upon approaching them we found the woodwork to be perfectly rotten and of a very old date, without any description of mark to yield the slightest information."—The interpreter, it seems, was of opinion that the transaction alluded to by the Esquimaux is traditionary,—and has in all probability reference to some affray between the natives and the early discoverers. The condition of the huts, as described by Capt. M'Clure, certainly helps to remove the story back from recent years to a distant period.

When abreast of the Horton river, between Cape Bathurst and Cape Parry, large volumes of smoke were observed,—and the look-out watch reported that he saw several persons moving about dressed in white shirts, and saw white tents in a hollow of the cliff. An examination of the locality confirmed the existence of the smoke,—which proceeded from fifteen small mounds, of volcanic appearance, occupying a space of about fifty yards. The entire ground was strongly impregnated with sulphur; and the land in the neighborhood was intersected by ravines and deep watercourses, varying in elevation from 300 to 500 feet. Marks of reindeer were seen in the vicinity,—and the temperature at the time (September the 6th) was warm. Several whales and seals played around the ship. The mystery of the white shirts and tents was thus satisfactorily explained:—and it is highly interesting in a physical-geography point of view to find these volcanic appearances at so high a latitude. The active volcano discoverd by Sir James Ross in a high latitude in the Antarctic regions will be in the remembrance of our readers.

Another discovery of great interest was made on the north of Banks Land by shooting parties who had proceeded a short way into the interior in search of game. This consisted of "a range of hills, composed of one entire mass of wood in every stage from petrification to a log fit for fire-wood. Many large trees were among it; but in endeavouring to exhume them, they were found too much decayed to stand removal." In the vicinity the heads of musk-oxen and the well-picked carcases of deer were frequently met with, and there was every appearance of the country being frequented by large herds of animals. Since the publication of Capt. M'Clure's despatches, an official return, of which the following is a copy, has issued from the Admiralty, showing the game killed by Capt. M'Clure's party, between the 1st of October 1850 and the 8th of April 1853. It is right, however, to state, that the principal part was killed during the spring of this year.—

	Number Killed.	Average Weight of each.	Total Weight.
Musk Oxen	7	378 lb.	1,945 lb.
Deer	110	70	7,716
Hares	169	6	1,014
Grouse	486	not weighed	
Ducks	198	"	
Geese	29	"	
Wolves	2	"	
Bears	4	"	
Total	1,005		

*Athenæum.

—It is supposed that this number would have been greatly augmented had the shooting parties gone into the interior of the country.

Another interesting table has been published, showing the monthly mean height of the barometer and the temperature of the air on board the Investigator from August 1850 to March 1853:—from which the following yearly abstract is drawn.—

Barometer.	1850.	1851.	1852.	1853.
Maximum	30.650	30.750	31 000	30.726
Minimum	29.160	29.030	28.970	29 180
Mean	29.828	29 931	29.906	29.960
Air.				
Maximum	+5	+52	+52	+17
Minimum	—40	—51	—52	—65
Mean	4.66	+1.58	+0.05	—35.92

Those who have perused Capt. M'Clure's voluminous despatches will have observed how triumphantly the Investigator battled with the thick-ribbed ice, which, according to her Commander's account, was constantly on the point of destroying her. This fact is certainly strong inferential evidence in favour of the opinion entertained by high Arctic authorities, that the Erebus and Terror—which were quite as strong as the Investigator—have not been crushed by the ice; and when people find the latter ship making a voyage with perfect safety of above 1,000 miles in the Arctic seas, continually surrounded, and frequently nipped, by the ice—a voyage which Sir Edward Parry states to be "the most magnificent navigation ever performed in one season, and perfectly marvellous in its nature," adding, that he "believes no man can tell more of the difficulty than he can,—it is not unreasonable to hope that the Erebus and Terror may be still in existence as stout ships. On the occasion of a dinner given lately, at Lynn, to Lieut. Cresswell, Sir E. Parry observed, that "there is that stuff and stamina in 120 Englishmen, that somehow or another they would have maintained themselves as well as a parcel of Esquimaux would."

A non-official letter from Capt. Kellett to a friend in London, dated from Mellville Island in May last, states, that game was very abundant on the island during the past autumn. He says —"musk oxen remained with us all the winter; one was shot in March. You cannot fancy a man wishing for a good tough beefsteak: but after preserved meats there is a great pleasure in getting between your teeth something to bite. The venison eaters of England ought to come here for it; nothing can exceed a haunch of good reindeer buck, tender and highly flavoured. Hares were shot in winter, and ptarmigan with full crops and in good condition, a fine cock weighing two pounds-and-a-half."—This account is the more satisfactory when we are told that the winter was very cold,—the thermometer being down to $-50°$ and $-57°$,—and for a considerable time the mercury was frozen.

We see by Capt. Kellet's letter that the great exploring Expeditions from his ship started on the 4th of April, in two divisions. Commanders M'Clintock, Hamilton, and two officers proceeded north,—and Lieut. Mecham west. Capt. Kellet accompanied Commander M'Clintock for a short distance, and then returned to his ship. On the preceding Sunday he read prayers,—and addressed the men, hoping that they would leave

little for any one to do after them. "We will do our best," was their response:—and Capt. Kellet adds,—"of this I am convinced."—Remembering the former extraordinary sledge explorations of the above officers,—and particularly those headed by Mecham and M'Clintock—there is little doubt that we shall hear of an immense tract of country and ice-covered sea having been explored this year:—and as Commander M'Clintock's route will lead him to the north-west of Victoria Channel, he may have the good fortune to find our missing countrymen.

Capt. Kellet states his intention of sending the Intrepid steamer to England with half the Investigator's crew. She must, he adds, be sent back to him again in 1854, with a transport of provisions. He represents Capt. M'Clure as being in excellent health,—and says that his officers are animated with the greatest zeal. "My only duty has been to restrain it within proper limits."

The following is interesting.—"I intended to have written to Col. Colquhoun, giving an account of our experiments with powder in blasting the ice. With light ice, three feet thick, I found small charges of 4 or 5 pounds most effective. The 20-pounds charge simply blows out a hole; but with the heavy polar ice of 72 feet thick, M'Clure used as much as 250 pounds in one charge, and with great success. He recollected when in great difficulty the Colonel telling him, 'use 100 pounds.' This saved his ship.—*Notanda*,—Gimcracks on board Resolute:—Mr. Somebody's machine for driving pure air into the ship. Mr.——'s galvanic batteries; balloons, kites. We have too large a proportion of sails,—not enough leather for soles. Sleeping bags should be made up in bags ready made. A large proportion of stearine should be supplied. Mr. Dale's cooking machines have been very carelessly made."—This latter information is distressing, when we remember the delicious venison, and read that the provisions supplied by the Admiralty are all of the best quality. It is certainly hard upon our gallant Arctic explorers that their dinners should be spoiled in the cooking.

News has been received from Valparaiso, dated September the 14th, to the effect that the Isabel steamer, which left England in the early part of the year for Behring's Strait, in search of Sir John Franklin, has been arrested in her voyage at the above port, in consequence of the desertion of the men. Of course under these circumstances, the Isabel will winter at Valparaiso;' but we understand that Admiral Moresby will be prepared, if Lady Franklin desires, to furnish a fresh crew of able seamen to the Isabel next March, when she will resume her voyage to Behring's Strait.

An Epitome of a Lecture on Ottawa Productions, delivered before the Bytown Mechanics' Institute & Athenæum, on Tuesday, Nov. 15th, 1853; by Edward Van Cortlandt, Surgeon.

VARIOUS CONDITIONS UNDER WHICH IRON IS FOUND.

NATIVE IRON.

It is generally supposed that Iron never exists in the metallic state, but it is asserted that pure unadulterated Iron has been discovered at Canaan in the United States, Native Iron is likewise produced by the spontaneous ignition of Coal in the neighbourhood of iron deposits, and where it is known under the name of Native Steel. The greatest quantity if iron is found combined with Sulphur, Oxygen or Carbonic Acid, the first known as Iron Pyrites, is never worked as an Ore. The best Iron Ores are Oxides, but the greatest portion of British Iron Ore is a Carbonate.

METEORIC IRON.

The histories of all ages acquaint us of huge masses of Iron being found in various parts of the globe, and which are considered to be of meteoric origin, and in point of fact two masses of such were actually seen to fall at Hadrschina, near Agram, in Croatia, in 1751. Several masses have been found in Africa, and in South America, and in Siberia—the last mentioned was discovered by Professor Pallas, and weighed 1600 pounds. An enormous mass weighing 15 tons, was found in Peru, by Don Rubin de Colis. Captain Perry took some knives home which he obtained from the Esquimaux in one of his voyages, and which were made of meteoric iron. There is a mass of it which weighs three thousand pounds, deposited in the Natural History Lyceum at New York, and which was found at Red River, Louisiana; and a portion of a mass of meteoric iron, which fell at Santa Rosa, near Bagota was manufactured into a sword presented to Bolivar.

MAGNETIC OXIDE OF IRON.

Oxydulous Iron, Octahedral Iron.

It is this variety of Iron Ore which produces the Native Loadstone. It occurs in various parts of the world, especially in the North of Europe, and is that of which the best Swedish Iron is made, and it yields also the Wootz Steel of the East Indies. It is of an Iron black colour, darker than common Iron; its powder is pure black—it exerts a decided action on the magnetic needle, attracting and repelling, according as the positive or negative points are presented. This variety, which is found in several parts of this continent is called Native Loadstone. It is infusible before the blow-pipe, and soluble in Nitric Acid; it occurs in primitive rocks, chiefly of mica and gneiss; it is exceedingly rich in metal, yielding 80 per cent. It is very abundant in Sweden, and at Gallivara, beyond the Polar Circle, it constitutes an entire mountain. In the United States, it exists in the greatest abundance, and is worked in several places. On the western side of Lake Champlain, it is found in beds of 20 feet thick. It ore produces the best steel and on this account it is that English weapons of superior description are always made of Swedish Iron.

This ore exists in inexhaustible quantities in various parts of the Valley of the Ottawa. The specimen before us was obtained from Lot No. 11, 7th Concession of Hull, and only four miles from the falls at the Chaudiere, where it constitutes a bed 20 feet in thickness, and there is a water power within 300 yards of it.

On the authority of Mr. Murray, the Assistant Provincial Geologist, we are enabled to state that a remarkable mass of magnetic Iron ore exists on the 24th Lot of the 6th concession of South Crosby, on an Island in Mud Lake, not far from Newborough, on the Rideau Canal; it has a breadth of ore of considerable purity of seventy yards. "The great supply of ore, says this gentleman, that might be here obtained, the proximity of wood in abundance for fuel, and the existence of water power at no great distance, combined with the advantage of a navigable canal, the water of which is in contact with the ore, render the locality well worthy of attention to such as are disposed to attempt the smelting of Iron in the Province."

The Geological formation yielding the magnetic oxides of Canada and those of the United States (where they prevail in equal abundance) are identical, says Mr. Logan. and it is probable they are both of the same formation as that of the Swedish mines. But the practical experiments on Canadian ores are still so few that nothing can yet be proved from them.—*Vide Report of Geological Survey*, 1851-'52, *page* 46.

SPECULAR IRON ORE, RED IRON ORE, IRON GLANCE.

The lustre of this ore of Iron is metallic, its color a dark steel gray, it is infusible before the blow-pipe, but melts with Borax. The great locality of this ore is the Island of Elba, which has been noted for producing it for sixteen centuries back, and its mines are considered inexhaustible; but it is also found in Saxony, Bohemia, Sweden, Siberia, Massachusetts in the United States, in England, and lastly, but not least, in the Township of McNab on the Ottawa River. Wherever it exists it is explored with profit. It is found at Ticonderago, where it is pulverized and used as a polishing powder. Most of the plate iron and iron wire of England are manufactured from this ore. It is extensively used in the button trade as a polisher, and the ore most in demand for this purpose comes from Spain. The best specimens for button polishing command a very high price, and are generally obtained from small pebbles;—it is worked at Utica in the United States with profit. This ore exists in enormous quantities at the mouth of the Madawaska in McNab Township; it is a very valuable species and is very easily smelted, and possesses every requisite for that purpose on the spot. A splendid specimen of this ore was presented to the Bytown Mechanics' Institute at the time of our Exhibition, and attracted the marked attention of the Governor General. The ore bed is twelve feet in thickness, and will yield 25 tons pure iron for every fathom in length and depth. The ore contains 55 per cent of pure metal.

BOG IRON ORE.

Hydrated Peroxide of Iron, or Brown Iron ore.

This Ore is generally found in detached portions at the bottom of shallow lakes and morasses, and hence its name—Bog Iron, and possesses several characters in common with Specular Iron Ore. It is made up of numerous aggregated fibres, and in colour it is invariably some shade of brown; it is very brittle, and possesses no magnetic power. On some occasions we meet with it in a more or less pulverized condition and assuming the appearance of an ochre, but it differs from all the other Ores of Iron, in containing water in large quantities, not simply absorbed, but constituting a characteristic part of the Ore, being chemically combined with it in the proportion of one-sixth.

Bog Iron Ore is only found in limited quantities in England, France, and Siberia. It is uncommon in the northern countries of Europe, but in Germany, France, and Austria it is extensively worked. At Salisbury in Connecticut, it exists to an unlimited extent, and has been worked for more than one hundred years, yielding from this locality alone the large quantity of two thousand tons of Iron annually.

The Iron obtained from Bog Ore is said to excel in toughness and hardness, and to be preferable to Red Iron Ore on that account, whilst the purer varieties, on being melted with charcoal, may be readily converted into steel of an excellent quality.

Bog Iron Ore is of more recent origin than any of the other Ores of Iron, and its deposition is going on continually, even at the present time in shallow lakes and swamps. In the south-western parts of New Jersey, where Bog Iron Ore occurs in great abundance, many spots previously exhausted are explored again successfully, after the lapse of about twenty years. And what is more curious than all we have yet said of it is, that it is brought to the state we find it in through the intervention of an infusorial animal called the *Gaillonella ferrugince.*

At Sweden, Bog Ore has been fished up from the bottom of the sea, where, according to Hansmann, it is still produced. It is worked in every quarter of the globe, but its Ore is generally used for castings, which are said to take a sharper impression from the phosphoric acid, which Bog Iron Ore always contains.

The Iron produced at the St. Maurice forges at Three Rivers, is obtained entirely from Bog Iron Ore, and is, as is well known, of an excellent quality, and is just now largely worked by the Hon. Jas. Ferrier, of Montreal; and a new company has also started in opposition, headed by Mr. Hale. These forges were commenced by the French Government in 1737, and it is said most of the French cannon handed to the British at the capitulation were made there.

During the last American war these forges were of signal service to the British army, having manufactured a large number of cannon balls and shells, at a time they were much needed.

It exists on the Ottawa on an eight feet bed at Cote St. Charles, on Lots 16 and 17, the property of Mr. R. Lancaster, who kindly forwarded these specimens to the Exhibition. Bog Iron Ore is known to exist in the Township of McNab, and other localities in the Valley of the Ottawa, but which as yet have not been explored.

" To metallurgists the good quality of the wrought Iron of the St. Maurice forges (says Mr. Logan) appeared the more deserving of attention, as the ore from which it is derived, being the Hydrated Peroxide, is usually accompanied by a small amount of Phosphorus, in the form of Phosphate of Iron. It is difficult to remove the impurity which in too large a quantity renders the metal cold short. In cast Iron however its presence in small quantities cannot be called prejudicial, as it serves to render the metal very fluid when fused, and thus to give a fine surface to the castings, and bring out all the details of ornamental patterns in sharp relief, whilst it does not seem to render the casting brittle or to deteriorate its power of resisting the effect of sudden heating and cooling. " The Peroxide of McNab contributed to the Exhibition in London by Mr. Sheriff Dickson, of Pakenham, was regarded as a very beautiful ore, the uniform quality of which would render it one of much more easy fusion and management than the magnetic oxides, while it would probably produce an iron of excellent quality."

IRON PYRITES.

Bisulphuret of Iron.

Is found in small cubical chrystals, in veins amongst Slate and Coal Fields, where, by oxidation and its conversion into Sulphate of iron, it not unfrequently, by raising the heat to a great degree, causes the ignition of the Coal. It is also found accompanying the ores of many other metals, and often replaces the remains of animal and vegetable substances.

In Tierra del Fuego, at the extremity of South America, the natives procure fire by rubbing a piece of iron Pyrites very briskly against a flint, and catching the sparks upon dry moss, —a striking approximation to our flint and steel.

Iron Pyrites is never used for the purpose of obtaining metallic iron, but is employed in the manufacture of Alum, Copperas, and Sulphuric Acid, consequently is of little value to us in this part of the Globe.

Mr. Logan referring to the Iron Ores of Canada, as they appeared at the Great Exhibition, remarks " The vast supplies of Iron with which the collection gave evidence that the Colony is enriched, appeared to arrest the attention of all. The British Miner accustomed to follow into the bowels of the earth, beds of ore of six inches to one foot, containing between 30 and 40 per cent, of this important metal, naturally regarded with surprise huge blocks of it from beds of 100 and 200 feet in thickness, and yielding 60 to 70 per cent;" And again, " the Canadian Iron Ores were examined with great care and attention, by the agents of Russia; it seemed to strike them with wonder that such pro-

digious sources should be found in any country but their own, and the public in general, without taking into consideration the question of its present application to profitable uses, seemed to regard the great beds of Magnetic Oxide, as national Magazines, in which was stored up a vast amount of a material indispensable to the comfort and progress of mankind, which it is always satisfactory to the inhabitants of a country to know is within their reach and control, should circumstances arise to render its application expedient or necessary."—[Vide report for 1851 and 1852, pp 45 and 46.

PLUMBAGO.

Graphite, commonly called Black-lead.

Plumbago is found in various parts of the world, in detached rounded lumps, and in veins of mica slate, Gneiss, and in transition rocks, and although called black-lead, there is not one atom of lead in its composition, it being a carburet of iron. It is found of the best quality in a mountain called Borrowdale, in Cumberland. The mine has been worked since the days of Queen Elizabeth, and is now nearly exhausted, the consequence of which is that Cumberland black-lead brings a very high price.

Plumbago also exists in many other parts of the world, where although not of a quality fit for lead pencils; it is profitably worked for other purposes, chiefly for converting into crucibles; it is used however, for polishing grates and stoves, to prevent the friction of machinery, and a preservative of iron from rust. On the Ottawa, it is known to exist of a very pure quality at the iron mine in Hull, but as yet in such small quantities, as not to warrant its being worked. It exists also tolerably pure at Devil's Lake, near Newborough, on the Rideau Canal. It is also found in large quantities, but of an inferior description, at Grenville, yet if properly cleared, would no doubt answer for crucibles.

The opinion of some of the great pencil-makers of the metropolis was obtained by Mr. Logan in regard to its applicability to the purpose of their trade, and "although it was found that the plumbago could, by washing, be freed from its impurities, and after the method of Mr. Brockedon, be converted into pencils, they would be considered of inferior quality.

LEAD ORE—GALENA.

Lead was well known to the ancients, and was used in Britain from very ancient times. Amongst the Romans it constituted a most important article of commerce, blocks and pigs of it having been frequently discovered, bearing Latin inscriptions, and the remains of Roman establishments are found in the neighbourhood. Several pigs of lead are deposited in the British Museum bearing Roman inscriptioms.

After the departure of the Romans, the Saxons continued to work the lead mines, and are supposed to have been the first who buried their dead in leaden coffins, the remains of which are frequently met with in various parts of England. In the casting of lead, and where it is rapidly cooled, a cavity is produced, and which in rifle bullets is instrumental in causing them to swerve from a rectilinear course; on this account rifle and musket balls are frequently formed from rolled lead. If rain or river water is exposed for any length of time in open leaden vessels, the metal becomes oxidized and deleterious, and in cases where danger is to be apprehended in this way from cisterns, Doctor Christison advises their being filled with a very weak solution of phosplate of soda, by which they become covered with an insoluble coating.

Lead ore is found in several parts of Canada. It either is or has been worked near Kingston, with what results I do not know. It abounds on the Ottawa, and somewhere in our immediate vicinity, on the Gatineau, it is said to be so plentiful and so easy of access as if discovered to admit of being worked most profitably. But the secret of its locality is confined to the Indians, who look upon it with so much superstition that nothing can bribe them to divulge it; they are under the impression that when the white man discovers it, their race is to be swept away. I have in my private collection an Indian pipe made from an oaken knot, the bowl of which is most ingeniously lined with lead—it was found in an Indian grave at Rice Lake. It is found also in large quantities on the land of Mr. Marshall, at Fitzroy, and ere long, I have no doubt the Ottawa, amongst its existing and prospective manufactures will add lead to the number.

COPPER.

Native copper is as yet only known to exist in Canada in quantities worthy of attention at the Bruce and Wallace Mines, Lake Superior, where a company is just now working it very profitably —it is of a very pure description. We have a spear-head in the museum, evidently made of native copper, and shaped by hammering, which was picked up in Renfrew. It is probable that it was left there by some of the migratory tribes of Indians during their incursions across the country, on their way to the Ottawa, with a belligerent intention.

There is an engraving of a spear-head in the *Canadian Journal* for January, 1853, identical in every respect with our specimen, and which is described as a relic of the ancient miners of Lake Superior. It at all events shows us that the Aborigines were acquainted with the metal.

Having now concluded our descriptions of the metals, we hasten to enumerate some of the refractory materials and minerals of the Ottawa, amongst which are included:— Marbles, white mottled green, gray, brown—all of superior quality and easily worked; millstones; grindstones and whetstones; sandstones, white and yellow, for the manufacture of glass; phosphate of lime and shell marl, highly important as manures; hydraulic limestone, for making hydraulic cement. Dolomite, for the manufacture of Epsom salts, and containing 45 per cent. of carbonate of magnesia. Steatite or soap-stone, which is applicable to various purposes, since it is used in the manufacture of porcelain, and for polishing serpentine marble and mirror glasses. It constitutes the basis of cosmetic powders, and is a main ingredient in antiattrition pastes, and dusted on the inside of new boots, it causes them to slip on easily; lastly, it removes grease spots from silk and woollen cloths.

Amongst the minerals in the ladies' department and applicable to jewellery, we have Labradorite, which, when looked at in different lights, assumes the hues of changeable silk. Sunstone hyacynths and Oriental rubies and sapphires, together with amethyst, garnet, and peristerite, a new mineral discovered by my esteemed friend Dr. Wilson, of Perth, and deriving its name from the appearance it assumes of the beautiful colour of a dove's breast.

CLAY FOR BRICKS, TILES, &c.

Pottery clay of several varieties, also exists very generally throughout the Ottawa country.

Of the Woods of the Ottawa.

Amongst the ordinary wants and prerequisites of the human family, there is none involved in more doubt and darkness than the origin of Fire. And it is not known whether its first discovery was referable to the direct action of the Sun's rays, to spontaneous combustion, to percussion, to friction, or to an accidental mixture of different substances. The generally received opinion, however, is that the most primitive mode of producing it artificially was by rubbing two pieces of dry Wood together,

a means still resorted to by the Aborigines of many continents and Oceanic Isles. At all events, there is little doubt that the first Fuel consisted of Wood, however questionable the means by which fire was first obtained, and it is quite certain that it was used as such, even at the most remote periods.

EVERGREEN TREES.—PINES.

RED PINE.

Pinus Resinosa, Pin Rouge.

Is a large handsome Tree with scaly red bark. Its timber enters largely into commerce, and is fine grained, and of close texture; it is shipped in the form of squared logs, and as well undressed as Spars for Masts and Yards, for which purposes it is in great request; some deals are also manufactured from this wood; From its superior strength it is used for rafters in England, and is well adapted for supporting the slate and tile roofs of Britain, and owing to the great distance Lumberers have to go in search of it, it brings the highest price in the market. By far the largest quantity of Red Pine is derived from the Ottawa, and on the banks of some of its tributaries, large tracts of sandy land are entirely covered with it. It constitutes the only open Wooded Tree in Canada.

WHITE PINE.

Pinus Strobus, Pin Blanc.

This is the commonest and most majestic of all our Pines; it towers over all the other trees of the Forest, and attains a very great size. When growing in open situations, it is often feathered down to the ground, and when loaded with its large pendulous cones, assumes a very beautiful and picturesque appearance. White Pine is easily wrought, comparatively free from knots, and very durable. Its timber is most in demand for ordinary domestic purposes, a fact fully demonstrated by the tens of thousands of Logs, we see everywhere about our Saw Mills. From its superior size and lightness the lower masts of Ships are generally made of it, and its possessing the property of not splitting by the sun, fits it for their decks. This wood is our most extensive article of commerce, and is shipped in the shape of Masts, Planks, Boards, Shingles, Laths, and Squared Logs. This is one of the trees which furnish the Gum with which the Indians pay over the seams of their Canoes.

PITCH PINE.

Pinus Rigida.

Is the most symmetrical and beautiful of all the family of Pines, although it seldom attains a great size, and never thrives except on the most arid and sandy soils. As its name indicates, it is chiefly employed for making Pitch. It is an extremely rapid growing tree, and exists in large quantities at Sandy Point, Tor bolton, and although every tree on this locality was destroyed by fire about ten years since, they have been reproduced in numbers and of sizes already, which, but for the indisputable evidence of the neighbouring Farmers, could scarcely be believed. Tar and Lampblack are largely manufactured from this tree, in Vermont, by a very simple process. The knots being incorruptible, are found abundantly in groves of this pine, which are collected and piled upon a stone hearth, covered with sods and earth, and set on fire, the heat soon expels the Tar, which runs down a groove cut in the stone for that purpose. The Lampblack is only the condensed smoke of the same fire collected in large Wooden Troughs. The only purpose this wood is converted to when worked, is Pump-making.

SPRUCES.

Hemlock Spruce, Abies Canadensis, Pruche.

This tree is exceedingly abundant throughout Canada. It is a noble species rising to 80 or 100 feet, and measuring often from 2 to 3 feet in diameter. It is of slow growth, and is supposed to require 200 years to attain its full size. When from 25 to 30 years old, its appearance is exceedingly elegant, but when older its large broken limbs detract from its symmetry and beauty, and the naked stumps of the old limbs give the tree an appearance of decrepitude and decay. The wood is not of great value, and is chiefly employed for lathes and coarse indoor work. The bark is very valuable as a substitute for Oak Bark in Tanning, and is that almost exclusively employed in our Tanneries. A decoction of its bark is used as a sudorific, whilst a fomentation made by boiling its branches, is considered by Shantymen to be a Panacea for Rheumatism, and all sorts of swellings, and the "Sovereign'st thing on earth for a green wound."

BLACK SPRUCE.

Abies Nigra, Epinette Noir.

Is a native of the most inclement portions of our continent, growing most densely, and presenting a very sombre appearance; and as large tracts of country are frequently covered exclusively with this tree, it has gained for them the appellation of Black Wood Lands. It is remarkable for the regularity and symmetry of its branches, which taper in the most beautiful pyramidal manner from the base to the summit. The timber is of great value, and is used from its straightness, lightness and elasticity, for the yards of Ships, and to "bend like a Black Spruce topmast" is a common saying amongst Sailors; it is also used for the knees of Ships and other craft. From it is extracted the Essence of Spruce, so well known for its Antiscorbutic properties, and so largely employed in the manufacture of Spruce Beer. Large quantities of this timber are annually shipped off from Quebec, chiefly for the Irish market.

BALSAM SPRUCE.

Silver Fir, Abies Balsimea, Sapin.

This is a beautiful ever-green tree, rising in a pyramidal shape, from 30 to 40 feet. In open and cultivated grounds it becomes feathered down to the bottom, it is consequently much in demand as an Ornamental Tree. It is this tree which furnishes the Gum de Sapin, or Canadian Balsam, sold largely as a substitute for and under the name of Balm of Gilead, an article of Eastern production, and which brings a high price in the market. It is also the chief ingredient in several descriptions of Varnish, and particularly valuable for preparing a transparent limpid varnish for water colour paintings.

It is the branches and leaves of this tree which furnish the Lumberer with a rude and primitive bed, when far removed from the abodes of man, hunting up Timber-groves in the forest.

RED CEDAR.

Juniper Virginiana, Cedar Rouge.

The Canadian Red Cedar is identical with the Bermuda Cedar, which is so largely employed by the pencil makers. It grows from Cedar Island, Lake Champlain, to as far south as the Gulf of Mexico. It attains a height of about 60 feet; grows on the most sterile regions, and may frequently be seen springing out of the crevices of rocks growing most luxuriantly without any apparent nourishment. In this section of the country it is not applied to any particular use, but in the western district is largely used for fence rails. There is a peculiarity connected with this tree, which, although very ornamental, never produces two specimens alike, that is two trees of the same shape. A resinous gum called Gum Sandarach is obtained from the Red Cedar, which when pulverized is known under the name of Pounce, and used as an absorbent of ink, and to prevent its spreading over the

newly erased surface of paper; it is also largely employed by Cabinet-makers for making a superior transparent varnish. The essential oil is very fragrant and imparts a most agreeable odour to leather, and to it books in Russia owe their inviting smell.

WHITE CEDAR.

Thuya Occidentalis, Cedre Blanc, Arbor Vita.

The White Cedar never attains any great height, and is so universally known as the occupant of Cedar Swamps, that any lengthened description is uncalled for. The wood is soft, smooth, extremely light, and possesses an aromatic smell. It retains a permanent shape, and is so extremely durable as to have led to the saying, "as sound as a Cedar post." It is chiefly used for fences and the sleepers of cellars, and from it the Indian shapes the ribs of his frail bark.

The North American Fisheries.*

English commerce is an affair of the last three centuries, and really began on an extensive scale in the prosecution of these very fisheries. An enterprising German, Dr. Pauli, who had before brought to light the Saxon treasures of the Bodleian, has lately discovered in the accumulated dust of the tower, which he had the bravery to penetrate, a quantity of curious and instructive correspondence, concerning the trade of the island with the continent prior to and at the time of the discovery of America, when the Low Countries and the free towns of Germany controlled the commerce of the world. The more shame to Englishmen that this work has been done by a foreigner. It is evident that at that time there was little foreign commerce of magnitude in English hands. Newfoundland was discovered by Cabot in 1497, but many years passed away before the English fishermen took advantage of the rights they had acquired thereby. Harry the Bluff was too much occupied with his wives and the Pope to pay that attention to the extension of the foreign power of the kingdom which had characterized the latter years of the reign of his more vigorous father. In 1517 there were only about fifty vessels at Newfoundland—English, French, Spanish, and Portuguese. The reign of Queen Elizabeth was distinguished by a more vigorous aid to this branch of national wealth. A succession of laws was passed for the encouragement of the fisheries, and the capital of the country was largely embarked in the business. In 1577, there were fifty English vessels on the Banks, and in 1603 two hundred, employing 10,000 men. Sir Humphrey Gilbert had taken possession of the island in 1583, in the name of Her Majesty, and planted a colony there. The sad fate of this heroic man is familiar to all through the touching poem of Longfellow. It was not thought beneath the dignity of the first men in the realm to enrich, or attempt to enrich themselves by these adventures. Raleigh took them under his protection, and Bacon was one of the patentees to plant a colony "in the southern and eastern parts of Newfoundland, whither the subjects of the realm have been used annually in no small numbers to resort to fish." The fisheries increased so rapidly, and became so prosperous, that large numbers made the island their permanent home, and began boat-fishing from the shore, which so seriously affected the sea fisheries that in 1670, instead of two hundred as in the beginning of the century, there were only eighty English vessels employed there. The alarm was sounded by the merchants interested in the trade, and the same year a Government force was sent out to drive away British fishermen and destroy British property in a British colony. The destructive measure had the desired effect; in four years after the annihilation of the rival boat fisheries the vessels employed had increased to two hundred and eighty, and the men to nearly 11,000. The destructive wars with France which marked the eighteenth century, seem to have sometimes repressed and sometimes advanced this interest in the Island of Newfoundland. They resulted at last in driving the French out of the continent, since which time the boat-fishing has gained upon that carried on in vessels, until there are at present but eighty of the latter. The boats now number ten thousand, and produce an annual yield of a million quintals, valued at £600,000. The total annual produce of the fishing interest of the colony is estimated at about £1,000,000.

The fish are caught near the land, with lines, and as often as the boat is filled, the catch is put ashore, where the "cut-throats," the "headers," the "splitters," the "dryers," and the "salters," pass them through from stage to stage till they are converted into the identical salted codfish which constitute the Saturday's dinner and the Sunday's breakfast from Hudson's Bay to the Potomac.

The fluctuations of the French fisheries in these waters have been very striking. In the early part of the sixteenth century, they had a dozen vessels there from the coasts of Normandy and Britany. In the beginning of the seventeenth century they employed 150 vessels in this branch of industry—how large a portion off Newfoundland, we are not able to state, but probably a large one. In the middle of the eighteenth century, after the last fearful struggle of the reign of the magnificent Louis, but before the contest under his successor which lost the Canadas to France, nearly six hundred French vessels, employing 30,000 men were engaged in codfishing. The magnificent fortress of Louisburg was erected, at an expense of fifty millions of livres, to protect their interest, and control the continent of America and the surrounding seas. It fell into British hands in 1763, and was entirely destroyed. The French have now the right to fish off a certain portion of the coast of Newfoundland, and also with in the Gulf of St. Lawrence, and occupy as a rendezvous for their vessels in these rough seas the two desolate islands of St. Pierre and Miguelon, only two leagues in extent, and without wood or fuel. By the help of a large bounty (fifty francs per man on the outfit, and from twelve to twenty francs per metric quintal on the produce,) they succeed in maintaining four hundred vessels and twelve thousand men in this business, and produce annually from three to five hundred thousand quintals of fish. From this source though not a commercial nation, they are assured of an unfailing supply of seamen for the national marine. There is no better school for sailors than those seas. We have crossed them often and rarely seen them quiet. The mingling of the current of the Gulf stream, setting up from the Bay of Mexico, densely charged with caloric, which it retains even until it settles about the British shores, with the ice-charged stream from the north, produces a constant restlessness in the air above and the water below. Even if engaged in the boat-fishing off the Coast of Newfoundland, or about the Islands of St. Pierre and Miguelon, the French fishermen must pass through these seas; if engaged upon the Grand Bank, the most extensive submarine elevation in the world, and abounding in shoals of fish, he anchors with his little vessel of one or two hundred tons in deep water in the midst of them, and pursues his occupation in strong boats till the "fare" is secured, and then takes it to St. Pierre for curing. The interest could not be supported without a large bounty. It requires larger vessels and a greater outlay of money than the rival colonial boat fisheries, and is carried on with the disadvantages of a distant home and uncertain market. It is to be regarded rather as an element in French national strength than as an item in the national prosperity and wealth.

The Newfoundland and Labrador seal fisheries, one of the most valuable branches of this dangerous industry, were created by the French invasion of the British cod-fishing grounds,

* From Fraser's Magazine for November

have grown to their present magnitude within a very few years. The vessels employed for this purpose from Newfoundland now number three hundred and forty-one, and the men ten thousand. The annual yield of the seal-skin is 500,000, valued at £50,000, and of seal oil over six thousand tons, valued at £170,000. In the early spring when the ice begins to descend, they leave the island in vessels hardly large enough for a Thames yacht, and force themselves into the floating fields as far as they can. They gather in the "game" (rather than the "catch") from all sides, stripping off the flesh and the fat, and leaving the coarse meat behind. It is not difficult for one who is familiar with the sea to picture the peril of such an occupation—the floating masses of ice tossing about on the restless ocean, the little craft wedged in among it, and liable at any moment to be crushed—the fearful storms descending from the Arctic—the hurricane dashing the snow over the deck, and clothing the rigging with sleet—the tossing waters severing the loose ice and piling it in fragments—and above all, the prevailing northeast gales, driving the whole mass towards the mainland, and threatening instant destruction to all

The codfisheries also upon the Labrador coast have become very valuable, and are in the hands of the Newfoundland and United States fishermen. It is estimated "that about twenty thousand British subjects are at present required during the fishing season, in the catching, curing, and transporting the various products of these remote seas." The cod fishermen arrive on the coast in the latter part of May, and early in June, and anchoring in some quiet place, where they may ride in safety, they send out their boats, with a shipper and a man in each to look up the fish. If after search, none are found, or not enough to make it worth while to stay, they change their anchorage, until they find themselves in good waters. The fishing is carried on by boats, which return to the vessels with their catch, and the cleaning and curing is generally done by a portion of the crew who are taken for that purpose. Frequently British vessels take two "fares" in a season, in which case the second load is cured at home.

The other cod fisheries are at Cape Breton, Prince Edward's Island, Magdalen Islands, and the Bay of Chaleurs, in the Gulf of St. Lawrence, and in the Bay of Fundy, and about Nova Scotia and New Brunswick. The descendants of the French Acadians, whose memories are embalmed in Longfellow's *Evangeline*, still clad, according to Mr. Sabine, in the peculiar costume of Normandy, feebly prosecute the fisheries of the Magdalen Islands and of the Bay of Chaleurs in boats. The valuable waters which surround Cape Breton are turned to even less account.

The disputes between the United States and the British Government grow out of alleged aggressions on the Nova Scotia and New Brunswick fisheries. Nova Scotia, the Acadia of *Evangeline*, is perhaps the richest fishing ground in the world. It is surrounded with deep bays and harbours, swarmed with every species of the piscatory creation, that come to the very door of the fisherman's hut. He is thus enabled, at little expense, to take cod with boats and lines, and mackerel with sieves and nets, under the shore, safe from the reach of the storm and the swell of the Atlantic, and ought with an expenditure of the least possible energy, to drive out of the market the foreign competitor, who is obliged to fit out a large vessel, bring it a long distance, and is then not permitted to fish within three miles from the shore. But instead of entering into a manly competition, he enacts a stringent law against poaching, and calls upon the Home Government to enforce it, which is done in a very prudent manner, while he does little, according to Mr. Haliburton, but "eat, drink, smoke, sleep, ride about, and lounge at taverns." The Bank fisheries are nearer to this Province than to any other, the cod and mackerel lie on the shore for their exclusive catch, the shad, the salmon and the herring ascend their rivers, and yet they employ but ten thousand men in the business, and their exports of fish are less than £200,000 a year. They have most especially advantages for taking the mackerel, which come from the south in large shoals in the latter part of May and early in June, and make into the narrow inlets and the straits of Canso, on their way to the Bay of Chaleurs, to spawn. The Americans are obliged to catch this fish in the deeper waters with the hook; but the colonists have the advantage of taking them in the shallow waters off the shore with nets and sieves." To secure two, four, six, and even eight hundred barrels at a time, it is only necessary to set a sieve to tend it, and at the proper moment to draw it to the shore." They exported in 1851 a hundred thousand barrels of mackerel, or about one half of the whole catch of the same fish in Massachusetts the year before.

The American mode of catching this fish by line, is enthusiastically described by Mr. Sabine:—

"The master of the vessel after reaching some well-known resort of the fish, furls all his sails except the mainsail, brings his vessel low to the wind, ranges his crew at proper intervals along one of her sides, and, without a mackerel in sight, attempts to raise a *school*, *scool* or *shoal*, by throwing over bait. If he succeeds to his wishes, a scene ensues which can hardly be described, but which it were worth a trip to the fishing ground to witness. I have heard more than one fisherman say that he had caught more than sixty mackerel in a minute; and when he was told that at that rate he had taken thirty-six hundred in an hour and that with another person as expert, he would catch a whole fare in a single day, he would reject the figures as proving nothing but a wish to undervalue his skill. Certain it is that some active young men will haul in and jerk off a fish, and throw out the line for another with a single motion, and repeat the act in so rapid a succession that their arms seem continually on the swing, To be 'high-line' is an object of earnest desire amongst the ambitious; and the muscular ease, the precision, and adroitness of movement which such men exibit in the strife are admirable, ... Oftentimes the fishing ceases in a moment, and as if put an end to by magic: the fish, according to the fisherman's conceit, panc-stricken by the havoc among them, snddenly disappear from sight. . . . . . The approach of night, or the disappearance of the mackerel, closing all labour with the hook and line, the fish, as they are dressed, are thrown into casks of water, to rid them of blood. The deck is then cleared and washed; the mainsail is hauled down, and the foresail is hoisted in its stead; a lantern is placed in the rigging; a watch is set to salt the fish, and keep a look out for the night; and the master and remainder of the crew at a late hour seek repose. The earliest gleams of light find the anxious master awake, hurrying forward preparations for the morning's meal, and making other arrangements for a renewal of the previous day's work. But the means which were so successful then failed now, and perhaps for days to come; for the capricious creatures will not take the hook, nor can all the art of the most sagacious and experienced induce them to bite."

A word about the Bay of Fundy, and we have made the tour of the fishing-grounds. The fisheries within this bay are carried on by boats from the shore, and are deemed to be less important than those on the sea side of the Peninsula. The men engaged in them are poor and thriftless, and are so scantily paid for their dangerous occupation, pursued on a stormy coast, with tides of fearful height and velocity, that they have little temptation or opportunity to become anything better. The shore fisheries of the States and the Colonies here touch each other; but there is, strange to say, little jealousy between the subjects of Her Majesty and the "free and enlightened citizens" of the Republic, and the

colonial laws against poaching are consequently administered in the most lenient manner.

The rights of the United States fishermen in these waters are regulated by the Convention of 1818. They received by that instrument the liberty to fish "on that part of the southern coast of Newfoundland which extends from Cape Ray to the Rameau Islands, on the Western and Northern Coast of Newfoundland; from the said Cape Ray to the Quirpon Islands, on the shores of the Magdalen Islands, and also on the coasts, bays, harbours and creeks from Mount Joly on the southern coast of Labrador, to and through the Straits of Belle Isle, and thence northwardly indefinitely along the coast;" and the liberty to dry and cure in the unsettled bays of the same Newfoundland and Labrador coasts; and they renounced the liberty "to take, dry or cure fish on or within three marine miles of any of the coasts, bays, creeks or harbours of His Britannic Majesty's dominions in America not included within the above-mentioned limits;" provided their fishermen should be "admitted to enter such bays or harbours, for the purpose of shelter, and of repairing damages therein, of purchasing wood and of obtaining water, and for no other purpose whatever." The disputes grow out of this last clause, which John Bull says excludes his dear cousin from all the Nova Scotia bays, according to established principles of public law; while the young gentleman, in return, claims the right to fish in all bays over six miles from headland to headland at the mouth, and to enter the other for the specific purposes named. But, as we said before, we do not purpose to take this question out of the hands of the negotiators and deprive them of the glory of settling it.

The inhabitants of New England have been fishermen from the outset. Gosnold went fishing off the Massachusetts coast in 1602, and in honour of his success, gave the name of Cape Cod to the sandy arm which reaches round into the sea, and takes up a part of Massachusetts Bay. The steeple-crowned saints who followed in his footsteps some eighteen years after, had an eye to the same good things in coming to this "stern and rock-bound coast." A ten-years' residence amongst the herring-catchers in Holland had taught them the value of such matters, and they showed a commendable determination in taking hold of them and and turning them to a good purpose, which their descendants have since been constantly striving to imitate.

In 1625, they had established a settlement at Gloucester, on the opposite promontory of the bay; and at the close of the seventeenth century, the products of the colony of Massachusetts Bay amounted to £80,000. They were undoubtedly injured by the witch mania, which ran through that part of New England, to the terror of old women, honest men, and people whose measure of sanctity and reverence for the ecclesiastical rulers was in doubt; but the exports had advanced by the middle of the eighteenth century to £150,000, notwithstanding the wars for the possession of Canada and the fishing grounds. So large had the interest become, that New England was able to furnish seven thousand sailors for the expedition against Louisburg. Since the peace of 1815, it has not advanced in proportion to the increase in the wealth and power of the country. American statesmen attribute the want of vitality to the superior advantages which the colonial fishermen enjoy in the exclusive use of their shore fisheries, to the stringent enforcement of the provincial laws, and to the want of sufficient protection to those interests in the United States. But we are inclined to think that the real cause of the decline is to be found in the impulse given to other and more lucrative branches of navigation and commerce in the United States, which draws away capital and men from the fisheries; and to the improved condition of the labouring classes, which allows them better food than cured fish.

It is impossible to conceive anything less inciting than the Massachusetts shore all the way round from Plymouth to Cape Cod. In some places, there is scarcely a blade of glass to relieve the desolate appearance of the sand, and where the soil is firm enough to give it life, it is not deep enough to give it much strength. We have been told that the gardens, such as they are, in the extreme towns, are supplied with earth from Boston, brought down as ballast in the little craft which ply across the bay, and in the fishing smacks which land their cargo there, and then come home to winter. The island of Nantucket has even less claim to be called land. Without rocks, or rivers, or trees, or hills, and scarcely with grass, it just lifts its sandy surface above the level of the ocean, protected by a belt of breakers from the swell of the Atlantic, but by nothing from the storms that lash it into fury. As on the Western Irish, and the Eastern coast, so on Nantucket and Cape Cod everybody lives by the sea; and of course sometimes an unexpected hurricane brings mourning and desolation into every house. They have not much of this world's wealth, (or rather the Cape Cod people have not, for the islanders are rich from the whale fisheries,) but on the other hand they are not poor. In the winter the young men and damsels go to the public schools, and the fathers look after their matters about home, get the vessel, lines and nets in trim for the next year's work, read the local newspapers, (and possibly a weekly journal from Boston,) to "post themselves up" as to what is going on in the outer world, of which this is the only time they get a glimpse. Some one, the staidest and most respectable, is selected for the "General Court," in Boston: that is, for the Legislature of the State. Care is taken, however, to pick out a person who has not too recently enjoyed the lucrative salary of two dollars a day belonging to the office. He goes to Boston, finds lodgings in some cheap part of the town, votes knowingly on all questions connected with the inspection of fish, and leaves the rest of the legislation to take care of itself. Meanwhile, his neighbours have been getting ready for taking the spring fares, and in May, or early in June they set sail for the Grand Bank or for Labrador, or the Bay of Fundy, or Nova Scotia. Their mode of fishing resembles substantially that of the French, which we have undertaken to describe; and if they are successful, they return home in the autumn, having suffered much and passed through many dangers, and with a reward quite inadequate to the difficulties and perils.

Notes on Tin.

Mr. Layard, in his work on Nineveh and Babylon, in reference to the article of bronze from Assyria, now in the British Museum, states that the *tin* used in the composition was probably obtained from Phœnicia; and, consequently, that *that* used in the Assyrian bronze may actually have been *exported* nearly *three thousand* years ago from the British Isles. The Assyrians appear to have made an extensive use of this metal; and the degree of perfection which the making of bronze had then reached, clearly shows that they must have been long experienced in the use of it. They appear to have received what they used from the Phœnicians. It is said that the Phœnicians were indebted to the Tyrian Hercules for their trade in tin; and that this island owed to them its name of *Baratanac*, or Britain, the land of tin.

The Great Polgooth Tin Mine, in Cornwall, has been worked for tin from a period far too remote for the earliest record, and the histories of Cornwall have severally given it that notice to which it was entitled from its magnitude and importance. At least, from the time of the requirement of tin by the Phœnicians to the present, it has been wrought more or less, with short intermissions, and has yielded a greater quantity of ore than any other tin mine in the country of the same depth. In a geolog-

cal point of view, it presents some of the most remarkable features known in the science of mining, and has not unfrequently baffled all the known theory and practice of the day; and from this reason mainly, whilst other mines have started into existence at a much more recent period, and have been profitably worked to a great depth, this mine has only yet reached to about 110 fathoms. The mine during the last sixty years has not been sunk one single fathom.

CANADIAN INSTITUTE ESTABLISHED 1849

INCORPORATED BY ROYAL CHARTER.

First Ordinary Meeting, December 3rd, 1853.

The following gentlemen were proposed members of the Institute:—

Dr. W. Craigie,		Hamilton.
J. H. Hagarty, Q. C.,		Toronto.
C. J. Philbrick, M. R. C. S.,		"
C. E. Thomson, J. J. Bogert, S. E. Rykert,	Junior Members	Toronto.
R. Rothwell,		"
Professor W. Hincks,		"
" E. Chapman,		"
" D. Wilson,		"

E. G, O'Brien, Esq.. and S. Spreule, were appointed to audit the accounts of the past year.

The Annual Report was read by the Secretary. The following certificate, having reference to the proposal of honorary members, was presented and read:—

To the Secretary of the Canadian Institute:—

We certify that the following persons—Capt. J. H. Lefroy, R.A., F.R.S.; W. Logan, F.R.S., and G.S., Provincial Geologist; Col. E. Sabine, R.A., F.R.S.; Robert Stephenson, M.P.—are eminent for their attainments in Science, and do recommend the same for election as Honorary Members of this Society.

J. B. Cherriman,
Henry Croft,
F. W. Cumberland.

The following gentlemen having been provisionally elected by the Council during the recess, they were duly ballotted for and their election confirmed:—

The Hon. Francis Hincks, Life Member,		Quebec.
Rev. B. Cronyn		London.
E. Thompson,		Toronto.
A. P. Salter, D.P.L.S., Chatham		Chatham.
E. R. Jones,		"
Hon. P. B. de Blaquiere,		"
T. G. Gregory,		Windsor.
Rev. R. Whitwell,		Philipsburg.
J. E. Pell,		Toronto.
W. McCleary,		London,
Rev. W. Bleasdale		Trenton.
Col. K. Cameron,		Beaverton.
J. R. Burke,		Stanfold, C.E.
Dr. Thomas Macklem,		Chippawa.
C. J. McGregor, E. M. Crombie, S. W. Hallam,	Junior Members,	Toronto.

Second Ordinary Meeting.—December 10th.

The following gentlemen were proposed members of the Institute:—

Thos. C. Street,		Niagara Falls.
Rev. Dr. Willis,		Toronto.
Robert Ferrie,		Doon.
James Stephenson, Jr.,		Hamilton.
Peter Cameron		Toronto.
William Henry Purdy,		"
Donald McDonald,		"
Sam'l Street Machlem, S. D. Mayer,	Jun. Members	Toronto.

The following volumes of Bohn's Illustrated, Scientific, Standard and Antiquarian Library, were then presented to the Institute on behalf of H. G. Bohn, Esq., London, by A. H. Armour, Esq., Toronto:—

The Politics and Economics of Aristotle, translated, with Notes, original and selected, and Analyses, by Edward Walford, M.A., with Introductory Essay and a Life of Aristotle, by Dr. Gillies.

The Organon; or, Logical Treatises of Aristotle, with the Introduction of Porphyry, literally translated, with Notes, Analysis, &c, by Octavius Freire Owen, M.A.; 2 vols.

The Comedies of Aristophanes; a new and literal translation from the revised text of Dindorf, with Notes and extracts from the best Metrical Versions, by William James Hickie, St. John's College, Cambridge; 2 vols.

The Lives and Opinions of Eminent Philosophers, by Diogenes Laërtius, literally translated by C. D. Yonge, B.A.

The Comedies of Terence, and Fables of Phædrus, literally translated into English Prose, with Notes, by Henry Thomas Riley, B.A.; to which is added a Metrical Translation of Phædrus, by Christopher Smart, A.M.

The Life of Alfred the Great, translated from the German of Dr. R. Paub; to which is appended Alfred's Anglo-Saxon Version of Orosius, with a literal English Translation, and an Anglo-Saxon Alphabet and Glossary, by B. Thorpe, Esq., M.R.A.S., Munich.

The Annals of Roger de Hoveden, comprising the History of England, and of other countries of Europe, from A.D. 732 to A.D. 1201, translated from the Latin with Notes and Illustrations, by H. T. Riley, B.A.

The Chronicle of Henry of Huntingdon, comprising the History of England, from the invasion of Julius Caesar to the accession of Henry II.; also, the Acts of Stephen, King of England and Duke of Normandy; translated by Thomas Forester, A.M.

The Flowers of History, especially such as relate to the affairs of Britain, from the beginning of the World to the year A.D. 1307, collected by Matthew of Westminster; translated from the original by C. D. Yonge, B.A.; 2 vols.

History of the House of Austria, from the Accession of Francis I., to the Revolution of 1848; to which is added Gencsis, or the details of the late Austrian Revolution, by an Officer of State.

The Prose Works of John Milton, volume V, containing the Second Book of a Treatise on Christian Doctrine, translated from the original by Charles R. Sumner, D.D., Lord Bishop of Winchester; The History of Britain; The History of Moscovia; &c., &c.

Lectures delivered at Broadmead Chapel, Bristol, by the late John Foster, Third Edition, with Additions; 2 vols.

Fredrika Bremer's Works:—The Home; or, Life in Sweden; and Strife and Peace; translated by Mary Howitt; 1 vol.

——— ———: a Diary; Axel and Anna, and other tales, translated by Mary Howitt; 1 vol.

The Beauties of English Poetry, selected for the use of Youth, by E. Tomkins; Twenty-first Edition.

The Days of Battle; or, Quatre Bras and Waterloo, by an Englishwoman resident at Brussels in June, 1815.

The Physiology of Temperance and Total Abstinence; being an examination of the effects of Alcoholic Liquors on the Healthy Human System, by William B. Carpenter, M D., F.R.S.

Letters from Egypt, Ethiopia, and the Peninsula of Sinai—by Dr Richard Lepsius; with extracts from his Chronology of the Egyptians with reference to the Exodus of the Israelites; Translated by Leonora and Joanna B. Horner.

Norway and its Scenery—Comprising the Journal of a Tour by Edward Price, Esq., and a Road-book for Tourists; with Hints to Anglers and Sportsmen.

Cage and Chamber Birds; their natural history, habits, food, diseases management and mode of capture—Translated from the German of J. M. Bechstein, M.D.: with considerable additions on structure, migration and economy, by H. G. Adams, incorporating the whole of Sweet's British Warblers—with numerous illustrations.

China, Pictorial, Descriptive, and Historical, with some account of Ava and the Burmese, Siam and Anam,—with nearly one hundred illustrations.

The Constitution of England; or, an account of the English Government—by J. G. de Lolme. A new edition, with Life and Notes, by John Macgregor, M. P.

The Coin Collector's Manual; or Guide to the Numismatic Student in the formation of a Cabinet of Coins—by H. Noel Humphreys, with above two hundred and fifty illustrations on wood and steel. Two volumes.

Personal Narrative of Travels to the Equatoral Regions of America, during the years 1799 to 1804—by Alexander von Humboldt and Aimé Bonpland. Volume III.

It was then resolved that the thanks of the Institute be transmitted to Mr. Bohn for his handsome donation.

The following gentlemen, who had been proposed at the last Meeting, were balloted for, and duly elected:—

Dr. William Craigie	Hamilton.
J. H. Hagarty, Q.C.	Toronto.
C. J. Philbrick, M.R.C.S.	"
C. E. Thomson, J. J. Bogert, S. E. Rykert, R. Rothwell, — Junior Members	Toronto.
Professor W. Hincks	"
" F. Chapman	"
" D. Wilson	"

The following gentlemen were nominated as Office-bearers for the year 1854:—

Hon. Chief Justice Robinson, for President.
Professor Croft, for First Vice-President.
Professor Hind, for Second Vice-President.
Professor A. Chapman, for Curator.
Mr. Fleming, for Librarian.
Mr. Crawford, for Treasurer.
Professor Irving and Professor Cherriman, for Corresponding Secretary.
Mr. G. W. Allan, for Secretary.
Mr. A. H. Armour, Mr. Harman, Mr. Henning, Professor Wilson, Professor Buckland, Mr. Brunel, Professor Bovell, Mr. Walter Shanly, Professor Hodder, Mr. Thos. Ridout, Rev. Dr. Scadding, Mr. Brondgeest, Professor Cherriman, and Mr. Francis Shanly—for Council.

Mr. J. T. Brondgeest read a paper "On the Preservation of Food."—(*See page* 107.)

On motion of Mr. Armour, it was made an instruction to the Council to have an alphabetical list of the names of the present members of the Institute placed on the table on next Saturday exening.

Annual General Meeting.

DECEMBER, 1[illegible].

The following gentlemen were proposed members of the Institute:—

G. B. Holland	Toronto.
C. Hampden Turner	Rook's Nest, Surrey, Eng.
Henry Bennett	Toronto.
Elkanah Billings	Bytown.

The annual report of the Council was read by the Secretary and the account current of the Treasurer presented to the meeting.

The report was adopted.

ANNUAL REPORT.

The Council of the Canadian Institute, before retiring from office, have the honour to lay before the members the usual yearly report of the operations and progress of the Institute during the past Session, and the steps they have taken in carrying out the recommendations of the previous Council, and generally in furthering the objects of the Society.

During the Session of 1852-3, the following papers were read at the ordinary meetings:

1. On the Mineral Springs of Canada—By Prof. Croft.
2. On the Geology of Toronto.—By Prof. Hind.
3. On the Windrose at Toronto.—By Capt. Lefroy.
4. On the Provincial Currency.—By Prof. Cherriman.
5. On Oriental Literature.—By Jacob Hirschfelder, Esq.
6. On the Nottawasaga Valley.—By Sandford Fleming, Esq.
7. On the birds Wintering in the neighbourhood of Toronto—By G. W. Allan, Esq.
8. On the Genuineness of some of the Classical Authors—By the Rev. Dr. McCaul.

9. On the Causes which influence the Circulation of the Blood.—By Dr. Bovell.

10. On Ornamental Planting.—By Professor Buckland.

At the Annual Conversazione, an Introductory Address was delivered by the Hon. Judge Draper, which was followed by addresses from the following gentlemen:

Rev. Prof Irving—On Binocular Vision.

Dr. Hodder, on the Poisonous Plants in the neighbourhood of Toronto.

Rev. Dr. Scadding—On Accidental Discoveries.

T. Henning, Esq.—On Late Arctic Expeditions.

Although many of these papers were not only excellent in a literary or scientific view, but also of peculiar interest in connection with this Province, the Council cannot refrain from expressing their regret and disappointment, at the total absence of any papers on the Science of Engineering,—a science for the promotion of whose interests the Society was originally established, and which, considering the magnitude and importance of the engineering operations now going on in this country, should naturally include a large portion of the intellect of the Society.

The number of Members of the Institute was, at the period of the last report 112; during the last session, 135 new Members have been added, and a list of 16 new names will be submitted this evening for the ballot, being those of gentlemen who applied after the close of the Session, and whom the Council, according to custom, admitted provisionally,—the total number of members will thus be raised to 263.

The annexed Balance Sheet will show that the financial condition of the Society is flourishing, there being a balance in favour of the Institute of £145 16s. For this gratifying result, the Society is to a great extent indebted to the liberality of Government, who continue to aid them with the aunual grant of £250, and the use of the rooms rent free. This grant it has been the aim of the Council to expend on objects of permanent value, such as the Library, the Museum, and the *Canadian Journal.*

The Council have much pleasure in announcing the success which has attended the publication of the *Canadian Journal* in the manner advised by their predecessors. While serving as the official medium for the publication of the Society's transactions, it has also made good its claims to public support on independent grounds as a Scientific Journal, and the Council have every reason to expect that under the able conduct of its present editor, it will well sustain the high character it has already earned.

The circulation of the Journal is now about 440 copies monthly, and of the first volume there only remain at this time twenty complete sets which have been reserved by the Council for the purposes of the Institute; in view of this fact it has been deemed advisable to increase the number of impressions from 500 to 750, believing that the supply will not be in excess of the demand that may be expected.

It may here be mentioned that application was made to the late Post Master General, to allow the *Journal* to be transmitted post free, in reply it was stated that the Post Master General could not accede to the request, but would put the Journal on the same footing as the Anglo American Magazine, and allow it to pass at half rates The Council regret that the Post Master General was unable to see the distinction between a purely scientific Journal, published at the cost of a learned society, and without expectation or intention of profit, and a literary magazine, which however excellent in its aim and execution, can only be considered as the enterprise of a private individual, and on which the reduction of postage would merely tend to increase his personal profit. The Council hope that on a renewed application by their successors to the Post Office authorities, this decision, in view of the privileges granted to the Journal of Education and the Agriculturist, and still later concessions to the Press, will be considered.

The Council would take this opportunity of calling the attention of the Publishing Committee of the Journal, to the fact that the history and details of the many great Public Works of Engineering in this Province, are at present either unpublished, or only in such a shape as to be all but inaccessible to the general reader. The Council are led to believe that a great collection of drawings, and much important information now lodged in Government Offices, would be willingly placed at the disposal of the Committee for publication in the Journal, and that the outlay would be trifling in comparison with the benefits derived therefrom: they would therefore recommend their successors to take steps by which such publication may be effected, believing that the results will be highly beneficial in every respect.

In regard to the formation of a Library and Museum, as advised by the last Report, the Council have expended a sum of £140 4s. 9d. in the purchase of books for the former, in addition to an unexpended appropriation of £110, for books not yet delivered; keeping strictly in view the character of the Library as defined in that Report "one of Scientific reference."

The following are the works alluded to:

	VOLS.
Naturalists' Library	40
Totten on Mortars	1
Loudon's Encyclopædia of Architecture	1
——— Trees	1
——— Gardening	1
——— Agriculture	1
Johnston's General Gazetteer	1
Gwilts Encyclopædia of Architecture	1
Cresy's " Civil Engineering	1
Cuvier's Animal Kingdom	1
Agassiz and Gould's Zoology	1
Dana's system of Mineralogy	1
Bourne on the Steam Engine	1
" on Surveying and Engineering	1
Sim's Principles and Practice of Levelling	1
" on Drawing Instruments	1
Transactions of the Institutes of Civil Engineers	
" " Vol. 1	1
" " Vol. 2	1
" " 5 parts, Vol. 3	5
Abstract of philosophical Transactions, 1800 to 1850	5
Transactions of the Institute of British Architects	2
Pambour's Theory of the Steam Engine	1
Taylor's Scientific Memoirs, in parts	6
The Builder	10
Railway Practice by S. C. Brees	2
Weale on Bridges	3
Journal of the Astronomical Society	11
Civil Engineer and Architect's Journal	12
British Association Reports	19
Flora of North America	2
Volumes	135

The following periodicals are regularly taken in, and will be bound for the Library:—

Illustrated News,
Athenæum,
Builder,
Expositor,

Mining Journal,
Appleton's Mechanic's Magazine,
The Citizen,
Engineer and Architect's Journal,
Anglo-American Magazine,
Journal of the Franklin Institute,
Art Journal,
Journal of Education,
Silliman's Journal,
London Quarterly.
Edinburgh Do.
North British Review.
Westminster Review.
Blackwood's Magazine.
The Sunday Times.

The Council have also much pleasure in recording the following liberal and valuable donations:—

	VOLS.
From Capt. Lefroy,—	
Magnetical and Meteorological Observations	2
Professional Papers of the Corps of Royal Engineers	8
Brande's Chemistry	2
Meteorological Report, by Espy	2
Athenæum, complete year, 1840-41, in Nos	2
From W. E. Logan, Esq.,—	
Official Illustrated Catalogue of the Great Exhibition	3
Hood's Handbook to the Great Exhibition	2
From A. H. Armour, Esq.,—	
Sylva Brittanica, by Strutt	1
The Tower Menagerie	1
Appleton's Library Manual	1
Five Maps.	
From H. G. Bohn, Esq., of London,—(through Mr. Armour),—	
Wisdom and Goodness of GOD in Creation—Chalmer	1
Soul in Nature—by Oersted	1
Earth, Plants and Man	1
Whewell's Astronomy	1
Kidd's Bridgewater Treatise	1
Bacon's Novum Organum	1
From F. Cumberland, Esq.,—	
Report of Select Committee of House of Commons on Atmospheric Railways	1
Report of R. Stephenson on Atmospheric Pressure	1
Annual Report of Railway Commissioners	8
Guage Commissioners Report	2
Report on Water supply of Metropolis	4
" on Soft Springs of the Surrey Sands	1
" on state of Large Towns, &c	3
" of Metropolitan Sanitary Commissioners	5
" of De la Beche and Cubitt, on the Oldham Mills	1
" of Surveyor of Prisons	2
" of Dover Harbor Commissioners	1
" of Col. Phillpotts on Canal Navigation of the Canadas	1
Jurors Report of Great Exhibition	1
From the East India Company,—	
Magnetical and Meteorological Observations	20
From A. H Armour, Esq.,—	
Owen's Geological Reports	1
Bache's Coast Survey of United States	1

The Museum has been enriched by the following liberal and valuable donations:—

From Capt. Lefroy,—
Skin of a White Caribou,

From Mr. Maurice Baldwin,—
2 pair of large Stags Horns.

From Professor Croft,—
Case of Squirrels and Ground Hog.
3 Cases of Birds, containing 165 specimens.
Collection of 120 Geological specimens from the Hartz Mountains.

From the Rev. A. Bell, of Simcoe,—
130 specimens of fossils of various kinds; and, a collection of Indian Axes, Arrow heads, and remnants of pottery.

From Dr. Wilson, of Perth,—
45 Mineralogical specimens.

Various Minerals from Mr. Thomas and Mr. Ridout.
Model of a Locomotive from Mr. V. Parkes.
" Steam Engine "
Specimens of ornamental tiles from Mr. Cumberland.
" of Plaster Casts from Mr. Thomas.
5 specimens of Lizards and a Fossil Echinus, from Mr. Wm. Couper.

A case for the mineralogical collection was provided by a private subscription of some members of the Institute.

The Council would recommend the application of a considerable part of the funds to the increase of the Library and Museum, and in particular, would urge their successors to form Collections of the Woods, Stones, and Vegetable products of Canada, with especial reference to their use in Arts, Manufactures and Agriculture.

In making application, as recommended by the late Council to the Imperial and Provincial Governments for copies of various documents printed by their order, some delay has occurred, but the Council have reason to believe that measures will be taken during the ensuing sessions of Parliament in favour of the application.

The negociation that was opened last Session, with the Toronto Athenæum, proposing an amalgamation of the two Societies, has not progressed satisfactorily, no answer whatever having been made by the Athenæum to the proposals of the Institute. It is matter of regret thet two Societies in the same city, pursuing the same objects, composed in great measure of the same persons, and both enjoying support from Government, should remain dissimilar and thus run the risk of counteracting each other's efforts. The Council would advise that attempts be made to re-open the negociation by their successors.

The Council have to deplore the departure from this country of our talented and energetic President, Captain J. H. Lefroy. Considering the many services rendered by him to this Institute it was a very general opinion among the members that he should not be allowed to depart without some endeavour to express our grateful sense of his exertions, and a voluntary subscription was entered into to furnish a piece of plate of which we might request his acceptance, and also to provide a portrait of him for presentation to the Institute. Both these objects were accomplished by the subscription, with the exception of a small balance in excess of the estimate, which has been defrayed by the Institute. The portrait now hangs in the Society's room, and the piece of plate was presented at the Annual Conversazione.

The Council are of opinion, that to mark still more distinctly our recognition of Captain Lefroy's services, it is advisable to confer on him the title and privileges of an Honorary Member, and at the same time would also recommend that they be conferred on three other gentlemen,

W. Logan, Esq., Provincial Geologist,
Lt.-Col. Edward Sabine, R.A., and
Robert Stephenson, Esq., M.P.

That these gentlemen, the first on whom it has been proposed to confer this title, are "eminent in scientific pursuits," according to the terms of our Bye-laws, will be acknowledged by all, and the connection of the two former with this Province is too patent to require notice. Of Col. Sabine it may be remarked that to him was entrusted the reduction and analysis of the observations made at the Magnetic Observatories established by the Imperial Government, of which Toronto was one, and that it is from the Toronto observations that he has just derived his brilliant discovery of the Lunar magnetic variation.

In consideration of the great work on which Mr. Robert Stephenson is now engaged in this country, it was thought fit by the Council on his visit to Toronto to present a congratulatory address to him, describing also the nature of our Society, and requesting him to allow himself to be nominated an Honorary Member, to which he willingly acceded.

The formalities, prescribed by the regulations, have all been gone through in the cases of these gentlemen, and the names will be submitted to the Ballot in the proper form.

The Council have only to call attention to the alterations made in the regulations and Bye-laws at the last general meeting, and to report that they have worked well and do not seem to require further modification at present. A sufficient number of copies of the improved code has been printed and distributed among the members.

The Council would however suggest, with the view of extending still wider the usefulness of the Society, and bringing the country members into more active participation in its proceedings, the propriety of adding to the Council four Associates from among the country members.

In accordance with a recommendation passed at the last ordinary meeting, provision was made for opening the rooms of the Institute on each Saturday evening during the recess. Members, however, did not appear anxious to avail themselves of this privilege, and the Council would leave it for the Society to decide whether the practice shall be continued. The Council would also recommend the formation of committees of the members at the close of the Session, with the object of pursuing special branches of inquiry during the recess.

In conclusion, the Council would beg to draw the attention of the Society to the fact that their tenure of the present building is uncertain, and will probably terminate in a short time: it must be for the consideration of the Society whether it will be advisable to rent proper accommodation in other quarters, or whether the Society is now strong enough to attempt the erection of buildings of its own in a style worthy of itself, and the objects for which it has been instituted.

FINANCIAL STATEMENT FOR THE YEAR ENDING DECEMBER 3, 1853.

Dr.

To Cash paid on account for—

	£	s	d.
Annual Conversazione	48	9	11
Publication of Journal	408	2	4
Balance, Lefroy Testimonial	6	0	9
Sundries on account of Institute	89	15	6
Library Expenses	140	4	9
Mineral Case	5	10	0
To Cash appropriated for Books not yet delivered	110	0	0
" Due on outstanding account	0	18	6
" To Reader for Journal	5	0	0
Balance	145	16	0
	£959	17	0

Cr.

				£	s.	d.
Balance from 1852				287	10	10
By cash received for sale of Journal	£76	16	2			
By cash from Members	266	17	6			
				343	13	8
By private donations				8	15	0
Government Grant, 1853				250	0	0
By cash due on account of Journal	£15	0	0			
" From Members	54	17	6			
				69	17	6
				£959	17	0

The gentlemen proposed members at the previous meeting were then ballotted for, and duly elected, viz:—

Thos. C. Street, M. P. P.	Niagara Falls.
Rev. Dr. Willis,	Toronto.
Robert Ferrie,	Doon.
James Stevenson, Jr.,	Hamilton.
Peter Cameron,	Toronto.
W. H. Pardey,	Toronto.
Donald McDonald,	Jun., mem. Toronto.
S. D. Mayer,	Jun., mem. Toronto.

Capt. E. A. Walker, of Barrie, presented some geological specimens from Lakes Huron and Simcoe. Professor Croft presented two additional numbers of the Provincial Geologists' Reports. The thanks of the Institute were voted to Capt. Walker and Professor Croft, for their respective donations to the Museum and Library.

The election of officers for the ensuing year was then proceeded with, which terminated as follows:—

President:

Hon. Chief Justice Robinson.

First Vice-President—Professor Croft,

Second Vice-President—Professor Hind.

Treasurer—Dalrymple Crawford.

Corresponding Secretary—Rev. Professor Irving.

Secretary—G. W. Allan.

Curator—Professor Chapman.

Librarian—Sandford Fleming.

Council:

Professor Cherriman,	Francis Shanley,
Alfred Brunel,	Professor Hodder,
Thomas Henning,	Professor Wilson.

It was then resolved, "That the thanks of this meeting be presented to Professor Cherriman, to whose untiring exertions, as first Vice President in the absence of Capt. Lefroy, may be largely attributed the continued success of the Institute during the year just closed."

It was also resolved, "That the thanks of the Institute be presented to the other Officers and Members of the Council for their exertions on behalf of the Institute during their term of office."

Notices of Books.

CAGE AND CHAMBER BIRDS, *their Natural History, Habits, Food, Diseases, Management, and Modes of Capture, from the German of* T. M. BECHSTEIN, M. D., *with Additions by* H. G. ADAMS, *incorporating the whole of* SWEET'S *British Warblers, with numerous Illustrations.* H. G Bohn, London.

This is one of the most attractive of Bohn's illustrated library. The descriptions are given in popular language, with only the occasional intermixture of technical or scientific terms. The book thus commends itself to the attention of the class who are most likely to be interested in the habits and peculiarities of forest warblers.

It is precise and full in its description of the details of the food, breeding, diseases, mode of catching and attractive qualities of the beautiful creatures to which its pages are devoted. It is embellished with numerous well executed woodcuts, and is really in all respects a charming book. We select, as an illustration of the general style of the work, the following description of that well known curious bird, the common crossbill. Page 172.

THE COMMON CROSSBILL. *Loxia curvirostra Lin. Bec croisé, Bvf. Der, Fichten Kreutz schnabel, Bech.*

Description.—This remarkable bird, which is about the size of a bullfinch, is six inches eight lines long, of which the tail measures two inches and a quarter. The beak is almost one inch long, with this peculiarity, that the upper mandible bending downwards, and the lower mandible upwards, cross each other: hence arises the name of the bird. The upper mandible sometimes crosses on the right, and sometimes on the left side, according to the direction given it when in youth; it is soft and yielding; the beak is brown, of a lighter hue underneath; the iris and the feet nut brown; the shin bones eight lines high. The changes of colour, which are falsely reported to take place three times a year, are briefly the following:—The young male, which is greenish brown, with a partial hue of yellow, is, after the first moulting, light red, with the exception of its black quill and tail feathers. This hue is darker on the upper than on the under part of the body.

The change generally takes place in April and May; it is not till the second moulting that these colours pass into the usual greenish yellow. The red crossbills are therefore the males of one year old; the greenish yellow the old birds.

The females are either grey all over, with a little green on the head, breast, and rump, or irregularly speckled with the same colours. An old male then, as may always be observed in the Thuringian Forest, answers to the following description. It is, however, necessary that the birds should be taken from the nest, and not at the season of departure when no two exactly resemble one another in colour. This arises from the different times at which they have moulted, which, as is well known, has a great influence on the colour of birds. The forehead, cheeks, and eyebrows are green or greenish yellow, spotted with white; the back siskin green; the vent white, spotted with grey; the shank feathers grey. All over the bird, however, the dark grey colour of the feathers shine through the green and yellow, and gives all the parts, especially the back, a spotty appearance, for in reality, all the feathers are grey, and only their points yellow or green. The wings are blackish; the small coverts green; the two larger rows, as well as the last quill feathers, bordered at the end with whitish yellow. All the quill feathers, however, as well as the black feathers of the tail, have a very narrow border of green. If the crossbills are grey or speckled, they are young; if red, they are one year old, and have just moulted; if carmine, they are just about to moult for the second time; if spotted with red and yellow, they are two years old, and in full feather. All these differences may be noticed except at the time of laying; for as they do not make their nest at any fixed season, so neither is their moulting regular, from which arises the great variety in their appearance. From all this it follows that the crossbill has much the same varieties of colour as the linnet; and that it is only the red garb, which they wear for a year, which so distinguishes them from other birds. It is curious that the young ones, which are bred in aviaries in Thuringia in great numbers, never acquire in confinement the red colour, but in the second year either remain grey, or immediately receive the greenish yellow colour of the males who have twice moulted.

Habitat.—In a wild state, the crossbill inhabits Europe, Northern Asia and America. It frequents fir and pine woods but only when there is abundance of the cones. In confinement it must have a bell-shaped wire cage, of the form and size adapted for a canary. It may also be allowed to run about, if a pine branch be provided on which it may perch and roost. It cannot, however, be kept in a wooden cage, as it destroy the woodworks with its bill.

Food.—Its food, when wild, chiefly consists of fir seeds, which it partly extracts from the scales of the cones with its bill, and partly from the ground. It also eats the seeds of the pine and alder, and the buds and flowers of the sumach. If kept in a cage, it may be fed on hemp, rape, and fir seeds, or juniper berries. If allowed to run about, it is content with the second universal paste.

Breeding.—Its time of incubation is the most remarkable of its peculiarities, for it breeds between December and April. It builds its nest in the upper branches of coniferous trees of thin pine or fir twigs, on which is placed a thick layer of earth moss, lined within with the finest coral moss. It is not pitched inside and out with resin, as some have reported. Thefemale lays three to five greyish white eggs, having at the thick end a circle of reddish brown stripes and spots. The heating nature of their food preserves both old and young from the effects of the winter's cold. Like all grosbeaks, they feed their young with food disgorged from their own crops. They may be reared on bread soaked in milk, and mixed with poppy seed.

Diseases.—The exhalations of a room have a bad effect on these birds, so that they are subject, when in confinement, to sore eyes, and swollen or ulcerated feet. The country folk of the mountains are simple enough to believe that these birds have the power of attracting their diseases to themselves, and are therefore glad to keep them. A grosser superstition adds to this, that the bird, whose upper mandible crosses on the right of the lower, or, as they call it, a right crossbill attracts to itself the diseases of men; and that a left crossbill, or one whose upper mandible crosses on the other side, takes away the diseases of women. In some districts, the latter birds are preferred, as having most healing efficacy. Simple people daily drink the water left by these birds in their troughs, as a specific against epilepsy, to which, as well as apoplexy, the crossbills are subject.

Mode of Taking:—In either autumn or spring, they are easy to catch by means of a decoy. A stake, to which strong limed twigs have been attached, is fixed, with the decoy bird at its side, in some forest glade to which the birds are observed to resort. They will certainly be lured to the twigs by the "gip, gip, gip," of the decoy. In some parts of Thuringia, the country people place spring traps in the tops of the pines, a favourite haunt of the bird, and hang a good decoy in a cage on the highest branches. As soon as one bird perches, the others follow; and as many are often caught as there are traps, if the sticks on which the birds are to perch are alone allowed to project.

Attractive Qualities.—The crossbill is rather a silly bird in a cage, and uses its bill and feet for the purposes of locomotion, like the parrot. If in health, it swings its body up and down like a siskin, and utters its harsh and unmelodious song. The males, however, are not all alike in this respect, for the amateur prefers those which often utter the ringing note like "Reitz." or "Kreitz," called the crossbill's crow. It becomes so tame, that it may be carried in the open air on the finger, and accustomed to fly in and out of the house.

Naturalist's Calendar, for November and December, Toronto 1853. By William Couper.

The Great White Owl, (*Strix Nyctea,*) November 4th.—This bird inhabits the northern parts of America, Asia, and Europe. Its body is whitish, with lunated fuscous spots. In the Lapland Alps it is quite white, and hardly distinguishable from the snow. Mr. Bullock (*Linnean Transactions, Vol. XI, Part I,*) thinks it breeds in Shetland. It arrives on the peninsula opposite Toronto early in November, where (if not disturbed) it remains nearly three months. Some of them measure five feet in expanse of wing. Its food consists chiefly of musk rat, mice, and other small quadrupeds: it also chases the feathered tribe by day.

Dragon-flies, last seen, November 5th.

The Carab *Agonum Cupripenne*, taken on the banks of the river Don, November 15th. From the above locality, and on the same day, I took 8 species of *Carabidæ.* They were found in the drift-wood washed on the banks by the river, and under stones and logs.

On the 1st December, I took from a decayed stump of a beech tree two large beetles of the Elater family, (*Alaus Ocillatus.*) No trace of the larvæ could be discovered. The two taken are males, and from the position in which they were found in the timber, I am satisfied they were hybernating. As soon as they received the warmth from my hand, a general movement of their limbs took place; in turning one of them on its back, it possessed the usual power of springing. Mr. T. W. Harris, of Massachusetts, in his treatise on Insects injurious

to vegetation, says:—"I found many of them in old apple trees, together with their larvæ which eat the wood, and from which I subsequently obtained the insect in the beetle state."

I found in an oak tree, on December 1st, an Ichneumon-fly, having a red body; antennæ black, with ten of their middle rings white; legs black, with white bands; wings bluish. This insect is the third of the genus having red bodies, with part of their antennæ white, which I have noticed to hybernate. One species has been found for three successive winters, between the earth and the roots of White Ash in one locality, and what is more astonishing, under the same trees. Trees growing in the clearing are in many instances better protected throughout winter than many of the forest monarchs. If the field has been at any time cultivated, the earth generally becomes conically packed around the lower section of the trunk, which, if not disturbed for a year or two, will give place to a quantity of fibrous roots adhering closely to the bark. Insects has instinct to select this as a place to take their winter's rest. The small steel-blue *Haltioadæ* can be here found in societies of from fifteen to thirty, together with two or three species of *Coccinellidæ*, which also hybernate in society. Countless numbers of *Poduræ* hop about whenever their abode is disturbed. Cold appear to take very little effect on these minute insects—they display the same power of locomotion in the month of December as they would in the warmth of summer.

December 10th.—In removing the earth from an oak tree at Castle Frank, I discovered a large lepidopterous insect of the genus *Bomby*. Anterior wings reddish brown, and angulated, having two weaved streaks across each, and in their centre an oblong black dot; posterior wings of a brown satin colour, with white margin; antennæ filiform; tongue spiral, but short; body quite flat, with the tail indented. By these marks the moth can be easily distinguished from others of the same family. Lepidoptera are so rarely found torpid in this country, that I consider this instance well worthy of notice. The same species was taken by me during summer.

December 12th.—I visited Mr. Baldwin's bush, west of Yonge-street, for the purpose of obtaining Coleoptera. Those taken are principally bark-miners. Three species of *Cucuji* were found under the rind of Oak, Choke Cherry, and Maple, together with three other species of bark-miners—all appeared in perfect vigour when removed from the crevices they occupied. During my walk in this locality, I noticed that nearly all the standing timber is more or less attacked by beetles—trees in their second growth, even the giants of the forest, are fast decaying away. This cannot be attributed to bark-mining beetles alone, but to the powerful larvæ of the extensive family of *Cerambycidæ* and *Buprestidæ*. So long as fallen trees are allowed to remain on the ground, not a healthy piece of timber can come from that locality, for such decayed trees are the resort of the above beetles, and they tend to their increase.

The Polar Regions.

ON THE POPULAR NOTION OF A NAVIGABLE SEA AT, OR PROXIMATE TO, THE NORTH POLE.

Of the different communications made by me at the late meeting of the British Association, at Hull, that 'On the Popular Notion of an Open Polar Sea' has been most unfortunate in regard to the inaccuracy of the notices of it in the papers of the day. These notices having been subsequently repeated in journals of more permanency, and also referred to as my statements on certain popular and interesting questions concerning Arctic geography—as, for instance, in an article by Mr. Peterm ann in the *Athenæum* of October 22,—I feel it due to myself and to the public, to seek the opportunity, which I trust you will afford me through the medium or your journal, of correcting the most important of these errors,

Mr. Petermann says,—"In a paper read by the Rev. Dr. Scoresby before the British Association, at Hull, the learned author states, that by having reached the latitude of 80½° he believed he had penetrated further into the Arctic Regions than any other living man:"—a position which he then proceeds to question, and, according to the authorities adduced, to disprove. In other publications referring to the same communication of mine, a singularly mistaken statement, ascribed to me, to the following effect, is added:—That, "though his observations had left no doubt in his own mind that the country about the North Pole was one mass of stupendous blocks of ice,—he firmly believed, however, that the North Pole might be reached *by land*."

Now, what I actually stated on the first of these points—that quoted by Mr. Petermann—was to this effect:—that "no instance could, I believe, be produced in which the adventurous navigator had ever been able to push his way northward (except in one case, where I was personally engaged) beyond the eighty-first parallel,—the latitude, in such adventure, being determined by celestial observation, and the case verified by the production of the ship's journel kept at the time; but that, in the exceptional and remarkable case referred to, we had advanced to the latitude of 81° 30′ north (verified by two observations beyond 81° and by my personal journal kept at the time),—which, I apprehend, was the furthest point reached *by sailing*, within the experience of any living person of which we had reliable record."

And that statement, even if put in more general terms, so as to embrace the enterprises of times past, might, I believe, be fairly maintained. No doubt numerous cases may be found recorded in the collections of the Hon. Daines Barrington and others, in which far higher latitudes are stated to have been reached. But still, in support of my own statement at Hull, I may be permitted to say, that little or no value, obviously, can be attached to mere memorial authorities for remarkable attainments of this kind, where so many influences tend to produce exaggeration or delusion of memory. Yet of this memorial class, incapable of decided evidence, are almost all those of Mr. Barrington, as well as those of subsequent collectors of similar incidents, as far as I have seen, which have been adduced to show a navigable Polar Sea in the far North: The subject, indeed, was particularly discussed by me in the 'Account of the Arctic Regions,' Vol. I. pp. 40—49; and the conclusions as above have not yet, I believe, been contravened. Of the more recent cases adduced by Mr. Petermann in the *Athenæum* (see *ante*, p. 1258,) I am not authorised to speak; perhaps, further than to say, that unless the attainment of the high positions specified—latitudes 82° and 82° 60′—be grounded on observations of the sun, and taken from journals kept at the time, they cannot be relied on as evidence even of the navigableness of the ice-encumbered seas to these extents—much less for supporting the theory of an open Polar Sea.

Few of the cases adduced in support of the theory of an open Polar Sea admit of positive verification or disproval; but it is remarkable that of such cases as admit of being tested, all that I have met with may be refuted, Two of these occur in the instances recorded by Mr. Barrington, which may suffice for illustration,—the cases of Captain Clarke and Capt. Bateson, in 1773, where the former stated his having sailed to the latitude of 81½°, and the latter to 82° 15′. Now those cases belong to the year of Capt. Phipp's expedition towards the North Pole—they refer to advances in the same sea and at the same season, and, as will be obvious to the reader of 'Phippe's Journal,' must have been impossible: for that able officer, we find, was unable to advance beyond 80° 48′; where he was not only arrested by impermeable ice, but so dangerously involved therein as to have seriously contemplated the idea of being obliged to abandon his ships.

All the other cases that I know of, admitting of a satisfactory testing, equally fail; whilst there are the important facts, that of all the public expeditions undertaken, by this country with the object of approaching or crossing the Pole, not one ever reached *by sailing* the latitude of 81° north, and that a personal experience of twenty-one voyages to the Greenland Sea—in which I was from seven to nine times at the furthest navigable point and nearest the Pole, for the time, of any other adventurers in the world—gave but once an advance beyond 80° 34′, when we reached, under my father's unexceeded enterprise, the latitude of 81° 30′. In no other regions or meridian, I may add, has anything like such advances been made; nor can any of the cases of "open sea" quoted from the despatches of Sir E. Belcher and Capt. Inglefield show it to be actually navigable to so great an extent, nor, indeed, within 150 miles of it.

In my communication to the British Association on the popular notion of an open Polar Sea the several arguments usually adduced in favour of the theory were separately examined; but no reply attempting to controvert any of the facts or to shake the conclusions from them was elicited. Nor do the views recently set forth by Mr. Petermann, enlightened and comprehensive as in many respects they are, at all meet the facts and analogies—as far as I am able to judge—which I suggested in contravention of the popular theory. It had long been my wish, indeed, to have a subject of so much geographical interest duly examined,—and not carried, as it has prevalently been of late, by a sort of popular acclamation. With a view to this I made application to the President of the Geographical Society in the month of May last for my bringing a paper before that Society on the specific question, in order to its being fairly discussed; but the opportunity, within the fortnight which I had then at command, was unfortunately not afforded.

No inconsiderable ambiguity, it should be noted, has been thrown around the topic by the mixing up of two very different forms of the theory of the existence of "a Polar Sea,"—viz., the theory of the existence of a polar ocean, and that of a *navigable* ocean up to or immediately around the northern pole.

As to the theory, in the first of these forms, there is no difference,

Twenty-five years after M. de Humboldt, I explored in my turn the valley d'Aragua, having fixed my residence in the little town of Maracaibo. The inhabitants had now remarked, that for several years, not only had the lake ceased to diminish, but that it had even risen very perceptibly. Some fields that were formerly covered with cotton plantations were now submerged. The Isles de las Nuevas Aparacidas, which had risen from the waters in 1796, had again become shoals dangerous to navigation; the tongue of earth de la Cabrera, on the north side of the valley, had become so narrow that the slightest rise in the water of the lake covered it completely; a continuous N. E. wind was sufficient to flood the road which led from Maracaibo to New Valencia; in short, the fears which the inhabitants of the lake had entertained for so long a period had entirely changed their nature; they were now no longer afraid of the lake drying up; they saw with dismay that, if the water continued to rise as it had done lately, it would, in no long space ot time, have drowned some of the most valuable estates, &c. Those who had explained the diminution of the lake by supposing subterraneous canals, now hastened to close them up in order to find a cause for the rise in the level of the water.

In the course of the last twenty-two years important political events had transpired. Venezuela no longer belonged to Spain; the peaceful valley d'Aragua had been the theatre of many a bloody contest; war to the knife had desolated this beautiful country and decimated its inhabitants. On the first cry of independence raised, a great number of slaves found freedom by enlisting under the banners of the new republic; agricultural operations of any extent were abandoned, and the forest, which makes such rapid progress in the tropics, had soon regained possession of the surface which man had won from it by something like a century of sustained and painful toil. With the increasing prosperity of the valley, many of the principal tributaries to the lake had been turned aside to serve as a means of irrigation, so that the beds of some of the rivers were absolutely dry for more than six months in the year. At the period which I now refer to, the water was no longer used in this way, and the beds of the rivers were full. Thus with the growth of agricultural industry in the Valley d'Aragua, when the extent of cleared surface was continually on the increase, and when great farming establishments were multiplied, the level of the water sunk; but by and by, during a period of disasters, happily passing in their nature, the process of clearing is arrested, the lands formerly won from the forest are in part restored to it, and then the waters first cease to fall in their level, and by and by show an unequivocal disposition to rise.

In crossing the steppe of Baraba, in his way from Tobolsk to Baraoul, M. de Humboldt perceived everywhere that the drying up of waters increases rapidly under the influence of the cultivation of the soil.

Europe also possesses its lakes; and we have still to examine them from the particular point of view which engages us. M. de Saussure, in his first inquiries in regard to the temperature of the lakes of Switzerland, examined those which are situated at the foot of the first line of the Jura. The Lake of Neufchatel is eight leagues in length, and its greatest breadth does not exceed two leagues. On visiting it, Saussure was struck with the extent which this lake must formerly have possessed; for, as he says, the extensive level and marshy meadows which terminate it on the south-west, had unquestionably been covered with water at a former period.

The effect of forests, considered in this point of view, would therefore, be to keep up the amount of the waters which are destined for mills and canals; and, next, to prevent the rain water from collecting, and flowing away with too great rapidity. That a soil covered with trees is further less favourable to evaporation than ground that has been cleared, is a truth that all will probably admit without discussion. To be aware that it is so, it is enough to have travelled, a short time after the rainy season, upon a road which traverses in succession a country that is free from forests, and one that is thickly wooded. The parts of the road that pass through the unencumbered country are found hard and dry, while those that traverse the wooded districts are wet, muddy, and often scarcely passable. In South America, more, perhaps, than anywhere else, does the obstacle to evaporation from a soil thickly shaded with forests, strike the traveller. In the forests the humidity is constant,—it exists long after the rainy season has passed; and the roads that are opened through them, remain through the whole year deeply covered with mire;—the only means known of keeping forests-ways dry, is to give them a width of from 260 to 330 feet, that is to say to clear the country in their course.

If once the fact is admitted, that running streams are diminished in size by the effect of felling the forests and the extension of agriculture, it imports us to examine whether this diminution proceeds from a less quantity of rain, or from a greater amount of evaporation, or whether perchance it may be owing to the practice of irrigation.

I set out with the principle that it must be next to impossible to specify the precise share which each of these different causes has in the general result. I shall, nevertheless, endeavour to appreciate them in a summary way. The discussion will have gained something, if it be proved that there may be diminution of running streams in consequence of clearing off the forests alone, without the whole of the causes being presumed to act simultaneously.

With regard to irrigation, it is necessary to distinguish between that case in which an extensive farm has been substituted for an impenetrable forest, and that in which an arid soil, which never supported wood, has been rendered productive by the industry of man. In the first case, it is very probable that irrigation will have contributed but little to the diminution in the mass of running water; it may readily be imagined that the quantity of water used up by a dense forest, will equal, at all events, if not exceed, that which will be required by any of the vegetables which human industry substitutes for it. In the second case, that is to say, where a great extent of waste country has been brought under cultivation, there will evidently be consumption of water by the vegetation which has been fostered upon the surface; agricultural industry will thus tend to diminish the quantity of water which irrigates a country. It is extremely probable that it is to a circumstance of this kind that we must ascribe the diminution of the lakes which receive so large a proportion of the running streams in the north of Asia. It is almost unnecessary to add, that in circumstances of this kind the effect which is due to the simple evaporation of rain water is not increased; the loss by this means must be rather less, because from a surface covered with plants evaporation takes place more slowly than from one that is devoid of vegetation.

In the considerations which I have presented upon the lakes of Venezuela, of New Granada, and of Switzerland, the diminution may be directly ascribed to a less mean annual quantity of rain; but it may, with equal reason, be maintained to be a simple consequence of more rapid evaporation.

There are, in fact, a variety of circumstances, under the influence of which the diminution of running streams can be shown to be connected with more active evaporation. I shall confine myself to the mention of two particular instances, one noticed by

M. Desbassyns de Richemond, in the Island of Ascension; the other is from observations by myself, and is among the number of facts which I registered during my residence of several years at the mines of Marmato.

In the Island of Ascension there was an excellent spring, situated at the foot of a mountain originally covered with wood; this spring became scanty and dried up, after the trees which covered the mountain had been felled. The loss of the spring was rightly ascribed to the cutting down of the timber. The mountain was, therefore, planted anew, and a few years afterwards the spring reäppeared by degrees, and by and by flowed with its former abundance.

* * * * * * * *

We have still to inquire, whether extensive clearings of the forest—clearings which embrace a whole country—cause any diminution in the quantity of rain that falls. Unfortunately, the observations which we have upon the quantity of rain which falls in particular districts, are only of sufficient antiquity and accuracy in Europe, to be worthy of any confidence, and there the soil was cleared, before observation, in the generality of instances, began.

The United States of America, where the forests are disappearing with such rapidity, will probably one day afford elements for the complete and satisfactory solution of the question, whether or not the cutting down of forests causes any diminution in the quantity of rain which falls in the course of the year.

In studying the phenomena accompanying the fall of rain in the tropics, I have come to a conclusion which I have already made known to many observers. My own opinion is, that the felling of forests over a large extent of country has always the effect of lessening the mean annual quantity of rain.

It has long been said, that in equinoctial countries the rainy season returns each year with astonishing regularity. There can be no doubt of the general accuracy of this observation, but the meteorological fact must not be announced as universal and admitting of no exception; the regular alternation of the dry and rainy season is as perfect as possible in countries which present an extreme variety of territory. Thus, in a country whose surface is covered with forests, and rivers, and lakes, with mountains, and plains, and table lands, the periodical seasons are quite distinct. But it is by no means so where the surface is more uniform in its character. The return of the rainy season will be much less regular if the soil be in general dry and naked; or if extensive agricultural operations take the place of the primeval forest; if rivers are less common, and lakes less frequent. The rains will then be less abundant; and such countries will be exposed, from time to time, to droughts of long continuance. If on the contrary, thick forests cover almost the whole of the territory, if its rivulets and rivers be numerous, and agriculture be limited in extent, irregularity in the seasons will then take place, but in a different way; the rains will prevail, and in some seasons they will become as it were incessant.

The facts which have now been laid before the reader seem to authorize me to infer—

1st.—That extensive destruction of forests lessens the quantity of running water in a country.

2nd—That it is impossible to say precisely whether this diminution is due to a less mean annual quantity of rain, or to more active evaporation, or to these two effects combined.

3d.—That the quantity of running water does not appear to have suffered any diminution or change in countries which have known nothing of agricultural improvement.

4th.—That independently of preserving running streams, by opposing an obstacle to evaporation, forests economize and regulate their flow.

5th.—That agriculture established in a dry country, not covered with forests, dissipates an additional portion of its running water.

6th.—That clearings of forest land of limited extent may cause the disappearance of particular springs, without our being therefore authorized to conclude that the mean annual quantity of rain has been diminished.

7th, and lastly.—That in assuming the meteorological data collected in intertropical countries, it may be presumed that clearing off the forests does actually diminish the mean annual quantity of rain which falls.

Investigation of the Specific Heats of Elastic Fluids.

BY M. V. REGNAULT.

I have been employed for more than twelve years in collecting the elements necessary for the solution of the following general problem:—

"A certain quantity of heat being given, what is theoretically the moving force which can be obtained from it by applying it to the developement and dilatation of different elastic fluids, in the various circumstances which can be realised in practice?"

The complete solution of this problem would give the true theory, not only of the steam engines now in use, but also that of engines in which the vapour of water was replaced by other vapours, or even by a permanent elastic fluid, whose elastic force should be augmented by the heat.

At the time I began these researches, the question appeared to be more simple than it does at present. Starting from ideas then admitted in science, it was easy to define clearly the different elements which compose it, and I imagined processes by aid of which I hoped to succeed, in finding in succession their laws, and fixing their numerical data. But, as usually happens in the sciences of observation, as I proceeded in my studies, the circle continually augmented; the questions which, at first, seemed to me most simple, became quite complicated, and, perhaps, I should not have had the courage to attack the subject, if, at the beginning, I had understood all the difficulties.

It has been admitted, until lately, that the quantities of heat disengaged or absorbed by the same elastic fluid were equal, when the fluid passed from the same initial to an identical final state, in whichever direction the transition took place; in a word, it was admitted that the quantities of heat depended only on the initial and final conditions of temperature and pressure, and were independent of the intermediate circumstances through which the fluid passed. S. Carnot published, in 1834, under the title of *Reflections on the Motive Power of Fire*, a work, which did not at first excite much attention, and in which he admits, as a principle, that the motive force produced in a fire engine is due to the passage of the heat from the more heated calorific source which emits the heat, to the cooler condenser which finally collects it.

Mr. Chapeyron has developed mathematically the hypothesis of Carnot; and he has shown that, the quantities of heat gained or lost by the same gas, then, do not depend solely upon its initial and final state, but also upon the intermediate state through which it is made to pass.

The mechanical theory of heat has regained favour within a few years, and it now employs a great number of mathematicians. But the principle of Carnot has undergone an important modification—it has been admitted that heat may be transformed into

mechanical work, and that, reciprocally, mechanical work may be transformed into heat. In the theory of Carnot, the quantity of heat possessed by the elastic fluid at its entrance into the engine is found entirely in the elastic fluid which issues from it, or in the condenser; the work is done merely by the passage of the heat from the boiler into the condenser, while it traverses the engine. In the new theory, this quantity of heat is not entirely preserved in the form of heat; a portion disappears during its passage through the machine, and the work done is in every case proportional to the quantity of heat lost. Thus, in a steam engine with or without condensation, with or without cut-off, the work done by the machine is proportional to the difference between the quantity of heat which the vapour has at its entrance into the machine, and that which it keeps at the moment of its exit or condensation. In this theory, to obtain the maximum mechanical effect from a given quantity of heat, we must make this loss of heat the greatest possible; that is to say, the elastic force which the expanded steam keeps at the moment of its entrance into the condenser must be as small as possible. But in every case, in the steam engine, the quantity of heat utilised in mechanical work will be but a very small portion of that which we have been obliged to give to the boiler.

In a steam engine in which the steam is expanded, but not condensed, the steam entering under a pressure of five atmospheres, and discharged at atmospheric pressure, the quantity of heat which the steam has, when it enters the machine, is, according to my experiments, about 653 units; that which it retains at its discharge, 637. According to the theory of which I am speaking, the quantity of heat utilised in mechanical work is 653—637=16 units; that is, only $\frac{1}{40}$th of the quantity of heat given to the boiler. In a condensing engine, receiving its steam at five atmospheres, and the condenser keeping, constantly, an elastic force of 55 min. of mercury, the quantity of heat in the entering steam will be 653 units, and that which it has at the moment of its condensation 619; the heat utilised will be 34 units, or a little more than $\frac{1}{20}$th of the heat given to the boiler.

A larger portion of the heat may be utilised in mechanical work, either by overheating the steam before its entrance into the machine, or by lowering as much as possible the temperature of the condenser. But this latter means is hard to realise in practice; it would, moreover, require a considerable increase in the quantity of cold water necessary for effecting the condensation, which wastes power, and the boiler can only be fed by water which is but little heated. We shall attain the same end more easily by expanding the steam to a less degree in the machine, and condensing the steam by the injection of a very volatile liquid, such as chloroform or ether. The heat which the steam has at the moment of this condensation, and of which but a very small part would have been transformed into mechanical work, passes into the more volatile liquid, which it transforms into vapour of high pressure. By passing this vapour into a second machine, where it expands to the elastic force to which the injection water can practically reduce the condenser, a part of the heat is transformed into mechanical work; and a calculation founded on the numerical data of my experiments, shows that this quantity is much greater than could have been obtained by the further expansion of steam in the first machine. In this way can be perfectly explained the economical result obtained from two connected machines, the one working with water, the other with ether or chloroform, on which experiments have been recently made.

In the air engines, where the motive force is produced by the dilatation which heat produces upon the gas in the machine, or by the increase which it produces in its elastic force, the work done at each stroke of the piston will always be proportional to the difference of the quantities of heat in the air entering and leaving; that is, to the loss of heat by the air in traversing the machine. But as, in the Ericsson system, the heat which the air gives out is given up to bodies from which the entering air takes it again, and brings it back to the machine, we see that, theoretically, all the heat expended is utilised for mechanical work, whilst, in the best steam engine, the heat utilised in mechanical work is not the $\frac{1}{20}$th part of the heat expended. Be it observed here, that I neglect all the extraneous sources of loss, as well as the mechanical or practical obstacles which may present themselves in the application of the principle.

MM. Joule, Thomson, and Rankine, in England, and MM. Mayer and Clausius, in Germany, starting frequently from different points of view, have developed analytically this mechanical theory of heat, and have sought to deduce from it the laws of all the phenomena relative to elastic fluids. For my part, I have for a long time expressed, in my courses of lectures, analogous ideas, to which I have been led by my experimental labours upon elastic fluids. In these researches I, in fact, met anomalies which appeared to me inexplicable in the theories before admitted. To give an idea of them, I will cite some of the most singular examples.

First example.—1st, A mass of gas, under a pressure of ten atmospheres, enclosed in a space the capacity of which is suddenly doubled, the pressure descends to five atmospheres.

2nd. Two reservoirs of equal capacity are placed in the same calorimeter; the one is filled with a gas under ten atmospheres, the second has a complete vacuum; the communication between the two reservoirs is suddenly opened; the gas expands to double its volume, and the pressure is also reduced to five atmospheres.

Thus, in the two experiments, the initial and final conditions of the gas are the same; but this identity of conditions is accompanied by very different caloric results; for, whilst in the first case a considerable cooling is observed, in the second the calorimeter shows not the least change of temperature.

Second example.—1st. A mass of gas traverses, under atmospheric pressure, a worm, in which it is heated to 100°, then, a calorimeter, whose initial temperature is 0°. It raises the temperature of the calorimeter t°.

2nd. The same mass of gas traverses, under the pressure of ten atmospheres, the worm, in which it is heated to 100°, then the calorimeter at 0° under the same pressure; it raises the temperature of the calorimeter t'°, and experiment shows that t and t' are but slightly different.

3rd. The same mass of gas, under the pressure of ten atmospheres, traverses the worm, in which it is heated to 100°; but when it arrives at the orifice of the calorimeter at 0°, or to any point of its course, the gas dilates, and descends to the pressure of the atmosphere; so that it issues from the calorimeter in equilibrium of temperature with it, and in equilibrium of pressure with the surrounding atmosphere. An elevation of temperature, t'', is observed in the calorimeter.

According to the theories formerly admitted, the quantity of heat abandoned by the gas in experiment No. 3, ought to be equal to that of No. 2, diminished by the quantity of heat which has been absorbed by the gas during the enormous dilatation which it has undergone. On the contrary, experiment shows a higher value for t'' than for t' and t. I might multiply these citations, but I should anticipate what I have hereafter to say. I reserve the farther elucidation until I shall publish together the experiments which I have made on the compression and dilatation of gases.

However, the examples which I have just cited suffice to show

how careful we must be in the conclusions to be drawn from the experiments in which elastic fluids that are in motion, undergo changes of elasticity. and perform mechanical work often difficult to appreciate; for the calorific effects produced depend, in great part, upon the order and manner in which these changes have taken place.

Unhappily, if it is easy to announce vaguely a physical theory, it is very difficult to specify it with precision, so as not only to connect with it all the facts known to science, but also to deduce from it those which have heretofore escaped observation. The theory of luminous undulations, as it was established heretofore by Fresnel, presents the only example heretofore known in physics. The expression in equations of the problems of heat, looked upon in a mechanical point of view, leads, like all analagous problems, to an equation of partial differences of the second order, between several variables which are unknown functions of each other. These functions represent the true elementary physical laws, which must be known, in order to have the complete solution of the problem. The integration of the equation introduces arbitrary functions, the nature of which we must seek to discover by preparing the results given by the equation with those which direct experiments give, and with the laws derived from those experiments. Unhappily, in experiments on heat, direct experiments are rarely applicable to simple phenomena; generally, they attack complex questions, which depend on several of these laws at a time, and most frequently it is difficult to assign the part which belongs to each of them. The experimenter must then endeavour to modify the circumstances under which he operates, so as to vary as far as possible, in the respective experiments, the parts which belong to each of the elementary phenomena, and to the law which expresses it. He will thus obtain equations of condition which may be of great aid for the discovery of a general theory; for this, whatever it may be, must always satisfy these equations.

This is the manner in which I have directed my researches; and I have always endeavored to define, in the most precise way, the conditions under which I was working, so that my experiments might be of service, whatever theory might finally prevail.

I published, in 1847, the first part of my researches; they compose the second volume of the *Memoirs of the Academy* (*of Sciences of Paris*). Since that date I have not ceased to pursue them; but the experiments which they required were so numerous, the numerical calculations so long and troublesome, that it would have been impossible for me to have executed them, if I had been left to my own individual efforts. I have been powerfully seconded by M. Izarn, who had already lent me his assistance for the first part of my work, and by a young engineer of mines, M. Descos, whom the minister of public works has kindly appointed my assistant for the last two years, in order to hasten the conclusion of my work. Let me be permitted thus publicly to express my thanks for the indefatigable zeal with which they have seconded me.

The subjects to which my new experiments have been directed are the following :—

1st. The relations which exist between the temperatures and the elastic forces of a great number of saturated vapours, from the feeblest pressures up to twelve atmospheres.

2nd. The elastic forces of these same vapours, saturated or not, in the gases.

3rd. The elastic forces, at saturation, of the vapours produced by mixed liquids.

4th. The latent heat of these vapours, under different pressures, from the feeblest up to those of eight or ten atmospheres.

5th. The latent heats of vaporization of the same substances, in gases.

6th. The specific heats of permanent gases and vapours, under different pressures.

7th. The quantities of heat absorbed and disengaged by the compression and dilitation of gases, whether this dilatation takes place in a space whose capacity is augmented, or whether it takes place through a capillary opening in a thin wall, or by a long capillary tube.

8th. The quantities of heat absorbed by the gas, when it produces, during its expansion, a motive force which is altogether consumed in the interior of the calorimeter, or is principally utilised elsewhere.

9th. And, finally, the densities of saturated vapours under different pressures.

The experiments which have reference to these different questions, with the exception of the last one, are now nearly finished. But, as much time will still be required to put them in order, and discuss them with the proper care, I propose to present the general results, successively, to the academy, while awaiting the time when I can publish them together.

I will present at present my researches on the calorific capacities of elastic fluids.

The capacities for heat of elastic fluids.—The specific heat of elastic fluids may be defined in two different ways; in the first, the specific heat of an elastic fluid is the quantity of heat which must be given to a gas to raise its temperature from 0° to 1° cent., allowing it to dilate freely, so as to preserve a constant elasticity; in the second, it is the quantity of heat which must be given to it, to raise its temperature from 0° to 1°, forcing it to keep its volume, its elastic force increasing.

The first of these has been called the specific heat of a gas under constant pressure. The second, specific heat of a gas under constant volume. The first definition only, coincides with that which has been admitted for the capacity for heat of solid and liquid bodies; it is also the only one which has heretofore lent itself to direct experimental demonstration.

A great number of physicists have employed themselves during the last century, in the examination of the specific heats of elastic fluids; Crawford, Lavoisier and Laplace, Dalton, Clement and Desormes, De la Roche and Berard, Haycrafft, Gay-Lussac, Dulong, De la Rive, and Marcet, have successively published researches on this subject. The greater part of these physicists have sought to demonstrate experimentally certain laws to which they had been led by the ideas which they had formed *à priori* as to the constitution of elastic fluids. They have applied themselves to determine the numerical values of the caloric capacities of the different gases in relation to that of liquid water generally taken as unity, than to look for the simple relations which they supposed must exist among themselves. The conclusions to which they have come are generally very erroneous.

The work of De la Roche and Berard, which was crowned by the Academy in 1813, is still the most complete on this subject, and the one whose results differ the least from the truth. This superiority is caused not only by the extreme care which these skilful experimenters exercised in their experiments, but also by the direct method which they followed; whilst the greater part of the other physicists had recourse to indirect methods, in which the element they sought exercised frequently but a very feeble influence.

The general conclusions which De la Roche and Berard drew from their labours were as follows:—

1. The specific heats of the gases are not the same for all;

whether we consider them in reference to volumes or to weights.

2. The capacity for heat of atmosphere air (that of water=1) is 0·2669; that of the vapour of water 0·8470.

3. The specific heat of equal volumes of atmospheric air increases with the density, but in a less rapid progression. The ratio of the pressures being

$$\frac{1}{1{\cdot}3583}, \text{ that of the specific heat is } \frac{1}{1{\cdot}2396}.$$

4. De la Roche and Berard admit, on theoretic considerations, and resting, moreover, on direct experiments of Gay-Lussac, that the specific heat of the gas increases rapidly with the temperature.

These are the most precise notions on the specific heat of gases which we at present possess, and which are generally admitted by physicists. The limits within which I am obliged to confine myself, in the present extract, prevent me from discussing the methods which have been adopted by my predecessors, or to explain those which I have myself followed. I will merely say, that I have met, in this kind of researches, great difficulties, not only in the experiments, but also in point of theory; the considerations which I have mentioned at the commencement of this article will render them easily understood. Thus, although my first experiments are fifteen years old, and although I announced them at that epoch in the *Memoirs on the Specific Heats of Solids and Liquids*, it is only after using the most various methods, and after having forced the elements of their correction in opposite directions, that I now, with confidence, present my results to the Academy.

According to my experiments, the specific heat of air, compared with that of water, is

Between	— 30° and 10° cent.	0·2377
"	+ 10° " 100° ..	0·2379
"	100° " 225° ...	0·2376

Thus, contrary to the experiments of Gay-Lussac, the specific heat of air does not vary sensibly with the temperature. Experiments made upon some other permanent gases led to a similar conclusion.

In experiments made upon atmospheric air, under pressures varying from 1 to 10 atmospheres, I found no sensible difference between the quantities of heat which the same mass of gas abandons in cooling, through the same number of degrees. Thus, in contradiction to the experiments of De la Roche and Berard, who found a very notable difference for pressures varying only from 1 to 1·3 atmospheres, the specific heat of the same mass of gas is independent of its density. Experiments made upon several other gases led me to analogous conclusions. I, nevertheless, present this law with some reserve; I cannot yet decide whether the capacity for heat under different pressures is absolutely constant, or whether it undergoes a very slight variation; because my experiments, perhaps, require a slight correction for the state of motion in which the gas was.

The specific heat 0·237 of the air, compared with water, is notably smaller than the number 0·2669, admitted by De la Roche and Berard; it is derived from more than a hundred determinations made under different conditions.

The other elastic fluids whose specific heat I have determined are—

Simple gases.	Specific heats. By weight.	Specific heats. By volume.	Densities.
Oxygen	0·2182	0·2412	1·1056
Azote (nitrogen)	0·2440	0·2370	0·9713
Hydrogen	3·4046	0·2356	0·0692
Chlorine	0·1214	0.2962	2·44
Bromine	0·05518	0·2992	5·39

In casting the eyes over this table, it is immediately remarked that the specific heats of equal volumes of oxygen, azote, and hydrogen, differ very little from each other; so that we would be led to admit that the specific heat of the simple gases is the same, when these gases are taken under the same volume and at the same pressure. But for chlorine and bromine, numbers have been found nearly equal to each other, but much greater than those which were obtained for the other simple gases.

Compound gases.	Specific heats. By weight.	Specific heats. By volume.	Densities.
Protoxide of azote	0·2238	0·3413	1·5250
Deutoxide	0·2315	0·2406	1.0390
Oxide of carbon	0·2479	0·2399	0·9674
Carbonic acid	0·2164	0·3308	1.5290
Sulphuret of carbon	0·1575	0·4146	2·6325
Sulphurous acid	0·1553	0.3489	2·2470
Chlorhydric "	0.1845	0·2302	1·2474
Sulphydric "	0·2423	0·2886	1·1912
Ammonia (gas)	0·5080	0·2994	0·5894
Protocarburet of hydrogen	0·5929	0·3277	0·5527
Bicarburet of hydrogen	0·3694	0·3572	0·9672
Vapour of water	0·4750	0.2950	0.6210
" Alcohol	0·4513	0·7171	1·5890
" Ether	0·4810	1·2206	2·5563
" Chlorhydric ether	0·2737	0·6117	2·2350
" Bromhydric "	0·1816	0·6777	3·7316
" Sulphydric "	0·4005	1·2568	3·1360
" Cyanhydric "	0·4255	0·8293	1.9021
" Chloroform	0·1568	0·8310	5·30
" Dutch liquid	0·2293	0.7911	3·45
" Acetic ether	0·4008	1.2184	3·04
" Acetone	0·4125	0·8341	2·022
" Benzine	0·3754	1·0114	2·6943
" Essence of turpentine	0·5061	2·3776	4·6978
" Chloride of phospho's	0·1346	0·6386	4·7445
" Arsenic	0.1122	0·7013	6·2510
" Silicium	0·1329	0·7788	5·86
" Tin	0·0939	0·8639	9·2
" Titanium	0·1263	0·8634	6·836

The specific heat which I have determined for the vapour of water, by a great number of experiments, is 0·475; it is only about one-half of that found by De la Roche and Berard. It is very remarkable, that the specific heat of the vapour of water is very nearly equal to that of ice, or solid water, and only one-half of that of liquid water.

Researches on the Developement of the Viviparous Aphides. By Dr. W. J. Burnett.

"With every inquiring mind there is a deep interest connected with the developement of animal life. To watch the origin and rise of new forms, to trace the successive phases through which they pass, as the ideas on which they are formed become more and more definitely expressed, until finally they have their full incarnation in perfect animals; these, from the earliest times, have been favorite studies with some of the most genial minds, and over which they were accustomed to dwell with the profoundest delight.

"With a subject naturally so enticing, it is not surprising that the Old Fathers of our science soon learned many of the more general conditions which wait upon the introduction into life of new beings. In these studies, the class of insects has always been quite prominent for the materials it furnished; the commonness of these animals, and the readiness with which they are at all times obtained, render them easy objects of inquiry in all their conditions of life, and there can be no doubt that many of these

fine old naturalists who have long passed away, owe the basis of their high eminence to Entomological studies of this kind, into which they were seductively drawn in their earlier days.

Every naturalist is aware of the remarkable phenomena connected with viviparous reproduction of Aphides or plant-lice, for their singularity has led them to be recounted in works other than those of natural science, and, from the earlier observers, they have been a kind of wonder-stories in Zoology and Physiology.

I need not here go over the historical relations of this subject. The queer experiments and the amusing writings of the old Entomologists are well known. The brief history of the general conditions of the developement of those insects are as follows: In the autumn the colonies of plant-lice are composed of both male and female individuals; they pair, the males then die and the females deposit their eggs, after which they die also.

Early in the ensuing spring, as soon as the sap begins to flow, these eggs are hatched, and the young lice immediately begin to pump up sap from the tender leaves and shoots, increase rapidly in size, and in a short time come to maturity. In this state it is found that the whole brood, without a single exception, consists solely of females, or rather and more properly of individuals which are capable of reproducing their own kind.

This reproduction takes place by a viviparous generation, there being formed in the individuals in question young lice, which, when capable of entering upon individual life, escape from their progenitor and form a new and greatly increased colony. This second generation pursues the same course as the first, the individuals of which it is composed being like those of the first, sexless, or at least without any trace of male sex throughout.

These same conditions are here repeated, and so almost indefinitely. Experiments having shown that this power of reproduction under such circumstances may be exercised, according to Bonnet, at least through nine generations, while Duvan obtained thus eleven generations in seven months, his experiments being here curtailed, not by a failure of reproductive power, but, by the approach of winter, which killed his specimens; and Keyber even observed that a colony of *Aphis dianthi*, which was brought into a constantly heated room, continued to propagate for four years in this manner without the intervention of males, and even in this instance it remains to be proved how much longer these phenomena might have been continued.

The singularity of these results led to much incredulity as to their authenticity, and on this account the experiments were often and carefully repeated; and there can now be no doubt that the virgin Aphis reproduces her kind—phenomena which are continued almost indefinitely, ending finally in the appearance of individuals of distinct male and female sex, which lay the foundation of new colonies in the manner just described.

The question arises, what interpretation is to be put upon this almost anomalous phenomenon? Many speculations have been offered by various naturalists and physiologists, but most of them have been as unsatisfactory as they have been forced, and were admissible only by the acceptance in physiology of quite new features.

As the criticism I intend to offer upon some of these opinions will be the better understood after the detail of my own researches, I will reserve this further notice until the concluding part of this paper.

My observations were made upon one of the largest species of Aphis with which I am acquainted, the *Aphis Caryæ* of Harris.

While in Georgia this last spring, it was my good fortune that myriads of these destroyers appeared on a hickory which grew near the house in which I lived. The number of broods on this tree did not exceed three, for with the third series their source of subsistence failed and they gradually disappeared from starvation. The individuals of each brood were throughout of the producing kind, no males were to be found, upon the closest search; they were all, moreover, winged, and those few which were seen without those appendages appeared to have lost them by accident. I mention this fact, especially since it has been supposed by naturalists that the females were always wingless, and therefore that the winged individuals or the males appeared only in autumn.

The first brood, upon their appearance from their winter hiding place, were of mature size, and I found in them the developing forms of the second brood quite far advanced. On this account it was the embryology of the third series or brood alone, that I was able to trace in these observations. In a few days after the appearance of these insects, the second brood (B), still within its parent (A), had reached two-thirds its natural size. At this time the arches of the segments had begun to close on the back, and the various external appendages of the insect to appear prominently. The alimentary canal had been more or less completely formed, although distinct abdominal organs of any kind belonging to the digestive system were not very prominent. At this period, and while the individuals of generation B are not only inside of their parent A, but are also enclosed each in its primitive egg-like capsule,—at this time I repeat, appear the first traces of the germs of the third brood (C).

These first traces consist of small egg-like bodies, arranged two, three or four in a row, and attached to the locality where are situated the ovaries in the oviparous forms of these animals. These egg-like bodies were either single nucleated cells of 1-3000 of an inch in diameter, or a small number of such cells inclosed in a single sac. These are the germs of the third generation; they increase with the developement of the embryo, in which they have been formed, and this increase of size takes place not by an augmentation of the primitive cells, but by the endogenous formation of new cells. After this increase has gone on for a certain time, they appear like little oval bags of cells—all these component cells being of the same size and shape, there being no one which is longer and more prominent than the rest, and which could be comparable to a germination vesicle. While germs are thus constituted, the formation of new ones is continually taking place. This occurs by a kind of constriction process of the first germs, one of their ends being pinched off, as it were, and thus what was a single sac becomes two, which are attached in a moniliform manner. This new germ, thus formed, may consist of only a single cell, as I have often seen, but it soon attains a more uniform size by the endogenous formation of new cells within the sac by which it is inclosed. In this way the germs are multiplied to a considerable number, the nutritive material for their growth being apparently a sort of liquid with which they are bathed, contained in the abdomen, and which is here derived from the abdomen of the first parent. When these germs have reached the size of 1-300th of an inch in diameter, there appears on each, near one side, a yellowish, vitellus-looking mass of spots, which in size and general aspect are different from those constituting the germ proper. This yellowish mass increases *pari passu* with the germ, and at last lies like a cloud over and conceals one of its poles.

I would also insist on the point that it does not extend itself gradually over the whole given mass, and is therefore quite unlike a true germinative vesicle or a proligerous disc. When the egg-like germs have attained the size of 1-50th of an inch, then appears distinctly the sketching or marking out of the future animal. This sketching consists at first of delicately marked

estreatings of the cells, here and there, but which soon become prominent from furrows, and at last the whole form stands boldly out.

After proceeding with this subject in an able manner and to some considerable length, the learned author says:

If, in this discussion of some of the highest relations of physiology, we have not wandered too far from our subject proper, which we have thereby sought to illustrate, indirectly, we will revert to the thread of its discourse for a few concluding remarks:

The final question now is, what is the legitimate interpretation of these reproductive phenomena of the Aphides we have described? My answer to this has been anticipated in the foregoing remarks. I regard it as nothing but a rather anomalous form of gemmiparity. As already shown, the viviparous aphides are sexless; they are not females, for they have no proper female organs, no ovaries and oviducts. These viviparous individuals, therefore, are simply gemmiparous, and the building is internal instead of external, as with the Polyps and Acalephs; it, moreover, takes on some of the morphological peculiarities of oviparity, but all these similar conditions are economized and extrinsic, and do not touch the intrinsic nature of the processes concerned therein."
—*Proceedings of the American Association—Annals of Science*

On the parallelism of the lower Silurian groups of Middle Tennessee with those of New York.*

BY PROF. J. M. SAFFORD.

The Lower Silurian rocks of Middle Tennessee are divided into two natural, and well characterized groups. The Lower division, which has been named the *Stones River Group*, is a series of bluish and dove-colored limestones from 250 to 300 feet thick. These rocks are the lowest visible in this part of the State.

The Upper division, named the Nashville Group, is, in great part, dark bluish limestone, about 400 feet in thickness. We are acquainted with 200 species from these rocks, of which one half are new, the others being identical with New York species.

The Tennessee strata, under consideration, are the equivalents, generally, of the following New York groups: first, the Black River group (including the Chazy, Birdseye and Black River limestones); secondly, the Trenton limestone; and thirdly, the Hudson River group (including the Utica slate.)

This general parallelism is very clear and satisfactory. When we come, however, to search, in Tennessee, for the Trenton limestone, separated, as a distinct group, from the Black River rocks below, and from the Hudson River above, we are entirely lost.

The difficulties are these: First, many of the species, belonging exclusively to the Trenton limestone in New York, occur, in Middle Tennessee, mingled in the same strata with Black River fossils; in fact, many of them occur in a lower position than some of the Black River species, for instance the following group, *Stromatocerium rugosum*, *Streptoplasma profunda*, and *Columnaria alveolata*, is highly characteristic of the uppermost member of the Stones River Group; notwithstanding this the central part of the same group affords such Trenton fossils as the following: *Retepora fenestrata*, *Subulites elongata*, *Cyrtolites compressus*, *Bucania bidorsata*, *Bucania expansa*, &c., &c. In the second place, if we take the Nashville group, and study its Trenton, and Hudson River fossils, we find the same blending of species, some of the Trenton running up to the very top of the group, and some of the Hudson River appearing at its base. The Trenton species thus appear to lose their value in Middle Tennessee, as characteristic of a subdivision of the Lower Silurian rocks.

It is very different, however, with the species of the other New York groups. The Stones River group has throughout (excluding the Trenton species) a well marked Black River fauna; and so the Nashville group, which succeeds it, has a decided Hudson River fauna, while at the same time there is no blending of these characteristic species.

To illustrate these remarks, I have constructed the table on the following page, using all the described species common to the two States, excepting those found, either in both the Tennessee groups, or, in both the Black River and Hudson River groups of New York, for these do not bear upon the points before us; this excludes such species as *Orthis testudinaria*, *Pleurotomasia umbilicata*, *Leptæna sericea*, *L. alternata*, *Chætetes columnaris*, *Murchisonia bicincta*, &c., &c. Several *doubtful* species have also been excluded.

This table illustrates the blending in Tennessee, of Trenton with Black River species below, and Hudson River species above; and, also, the fact, that the characteristic Black River species are confined to the Stones River Group, while those characteristic of the Hudson River rock, are confined to the Nashville Group.

	NEW YORK.						TENNESSEE. Stones R. Group.			Nashville Group.		
	Chazy.	B. & B. R.	Low. Tren.	Cen. Tren.	Un Tren.	U. S. H. R.	Low.	Cen.	Up.	Low.	Cen.	Up.
1. Maclurea Magna	*	*						*				
2. Columnaria alveolata		*							*			
3. Streptoplasma profunda		*							*			
4. Stromatocerium rugosum		*					*		*			
5. Gonioceras anceps		*					*	*				
6. Lituites undatus		*						*				
7. Orthoceras fusiforme		*					*	*	*			
8. Buthotrephis? caespetosa			*					*				
9. Retepora fenestrata			*					*				
10. Leptaena filitexta			*					*	*			
11. Orthis tricenaria			*					*				
12. Bucania bidorsata			*					*				
13 Bucania expansa			*					*				
14. Pleurotomaria rotuloides			*						*			
15. Cyrtolites compressus			*		*			*				
16. Phacops callicephalus			*		*			*				
17. Edmondia ventricosa				*	*			*				
18. Ambonychia amygdalina					*			*				
19. Endoceras proteiforme				*	*			*				
20. Subulites elongata					*			*				
21. Spirifer lynx			*	*	*				*	*	*	
22. Orthis pectinella			*	*	*						*	
23. Murchisonia bellacincta			*		*						*	
24. M. subusiformis					*						*	
25. Atrypa modesta					*	*					*	*
26. Modiolopis anodontoides						*				*		
27. Favistella stellata						*					*	*
28. Ambonychia radiata						*					*	*
29. Avicula demissa						*					*	
30. Cyrtolites ornatus						*				*		

In view of all these facts it follows; First, that the Trenton limestone, as a distinct group, cannot be recognised in Middle Tennessee; and, Secondly, that the Nashville and Stones River groups are, respectively, the representatives of the Hudson River and Black River groups of New York, and that the former rests directly upon the latter.

It may be added too, that the facts, thus developed in Tennessee, show that it will hardly be satisfactory to unite, as has been suggested, the Trenton limestone, as a group, with the Hudson River rocks, for the blending of species takes place

* Proceedings of the American Association—Annals of Science.

downwards as well as upwards in as great, if not greater, proportion. So far as our Tennessee species are concerned, it would be a much more natural arrangement to unite the lower part of the Trenton limestone with the Black River rocks, and the central and upper portions with the Hudson River group. The Table, which has been constructed with reference to this view, illustrates this point sufficiently well. Most of the Trenton species in the Stones River group belong to the Lower division, and the few others may be found hereafter to belong to the same; while all of the Trenton species, in the Nashville group, belong to the Upper division, three of them being common.

If the New York species will admit of this classification, and we are inclined to think they will, the confusion, which has hitherto existed in regard to the parallelism of these groups, will in some measure, at least, be removed.

The parallelism will then be—

Nashville group.	Hudson River, Utica State, Cen. and Up. Trenton.	New group.
Stones R. group.	Lower Trenton, Black R. G.	New group: say Black River.

Photography—The Wax-Paper Process.

May I be permitted to detail a process I have found very successful during a photographic tour I have taken this autumn? It combines the advantages of extreme sensitiveness (two minutes being as effectual as ten by the ordinary method), together with the faculty of the excited paper keeping good for several weeks; two properties which I consider invaluable while working at a distance from home, as the papers can all be excited ready for the camera before commencing the journey, while the development can be deferred until the return home, provided the time elapsed after exciting be not more than about three weeks. By this means the necessity for carrying about a quantity of dishes, chemicals. etc., is avoided, the only requisites being the camera and stand, paper holders and prepared paper.

My method is a modification of Le Gray's process, in which the pores of the paper are saturated with wax previous to the formation of the surface. This is undoubtedly the best, both as regards the brilliancy of the finished picture, and the ease and convenience of manipulation; but there are several circumstances which tend to impair the beauty of the result, foremost of which may be mentioned the spots, one or two being generally to be met with even on the best paper, By the following slight modification I have succeeded in removing the impurities which cause the spots, and also in diminishing the time of exposure in the camera.

The paper I employ is the thin variety made by Canson, Frères. The first operation consists in waxing it: the sheets, cut to the proper size and marked on the smooth side, are to be soaked in melted wax, and afterwards separately ironed between blotting paper until there are no shining particles of wax to be seen on the surface.

The next operation consists in iodizing the sheets; the bath is composed of

Iodide of potassium	15 grains.
Water	1 pint imp.

with the addition of as much free iodine as will give it a sherry color. This removes the iron and brass, of which the spots generally consist: it will require renewing now and then. The sheets are to be completely immersed in this bath for at least two hours, taking care to avoid air bubbles, and then hung up to dry: they will be of a deep purple color, owing partly to the union of the iodine with the starch in the paper, and will keep good any length of time.

The solution for rendering these iodized sheets sensitive consists of

Nitrate of silver	15 grains
Glacial acetic acid	15 "
Water	1 ounce.

The marked side of the paper is to be laid carefully on this solution, and kept there for about half a minute longer than necessary to completely decolorize it (from seven to ten minutes), and then floated on distilled water for a few minutes. It must then be dried between blotting-paper, and kept in perfect darkness in a portfolio until required. With only one washing in distilled water, as above, it will not keep good longer than six days; but if washed sufficiently it will keep good for weeks.

It is hardly possible to state any definite time for the exposure in the camera, as this of course must vary with the intensity of the light; but with a lens of twelve inches focal length, with a half inch aperture in front of it, from one to two minutes will suffice on a bright day with the sun out; while on a dark gloomy day, from seven to ten minutes may be requisite.

For developing the picture, I employ four parts of a nearly saturated solution of gallic acid, and one part of the solution previously employed for exciting the paper; these are well mixed, and the marked side of the paper floated on it. The picture will soon begin to appear, and should be completely out in less than an hour, and before the gallo-nitrate is decomposed; it must then be washed, soaked in tolerably strong hyposulphite of soda until all the yellow iodide is removed, washed again several times, and then dried, and either ironed over, or held before a fire to melt the wax. The greatest care must be taken to have the dish perfectly clean to contain the gallo-nitrate; it ought to be rubbed with strong nitric acid now and then, to remove the stains from a previous operation; unless this precaution be taken to avoid the presence of dirt the picture will be covered with stains similar to marbling in book-binding. The gallic acid and nitrate of silver must also be filtered before mixing.

By adhering to these directions, any person who has a little experience in manipulation may be sure of getting excellent results, with a far less number of failures than by any other process. I have endeavored to state everything as explicitly as possible, but should I not have rendered myself sufficiently intelligible in any part of the process, I shall be happy to give any information that lays in my power.

WILLIAM CROOKES.

Hammersmith.

P. S.—I have seen several inquiries respecting the price that ought to be paid for a good lens, the general idea seeming to be that they are very expensive. The lens I always employ cost me fifteen shillings; it was made at Slater's, and is $1\frac{5}{8}$ inch in diameter, and 12 inches focus. The picture I forward as an illustration of the process will show what can be done with it: it was taken in one minute with a half inch aperture in front of the lens.—*Notes and Queries.*

The Earl of Rosse's Telescopes, and their Revelations in the Sidereal Heavens.

BY REV. W. SCORESBY, D. D., F. R. S., S. L. & E., etc.*

In a second lecture on these interesting subjects, recently delivered at Torquay, much and important consideration was given to the inquiry,—What has the gigantic telescope done?

The lecturer having himself had the privilege of observing on different visits, and for considerable periods, with both the instruments, was enabled to reply, he hoped in a satisfactory manner, to this inquiry. His opportunites of observing, he said, notwithstanding interruptions from clouds and disturbed atmosphere, had been somewhat numerous, and, not unfrequently, highly instructive and delightful. Of these observations he had made records of nearly 60, on the moon, planets, double stars, clusters, and nebulæ. He had been permitted also to have free access to, and examination of, all the observatory records and drawings, so that he was enabled on the best grounds, he believed, to say, that there had been no disappointment in the performance of the instruments; and that the great instrument, in its peculiar qualities of superiority, possesses a marvellous power in collecting light and penetrating into regions of previously untouched space. In what may be called the domestic regions of our planet—the objects in the solar system—all that other instruments may reveal is within its grasp or more, though by the prodigious flood of light from the brighter planets, the eye is dazzled unless a large portion is shut out.

But in its application to the distant heavens and exploration of the nebulous systems there, its peculiar powers have, with a steady atmosphere, their highest developments and noblest triumphs. In this department—that to which the instrument has been particularly directed—every known object it touches, when the air is favorable, is, as a general fact, exhibited under some new aspect. It pierces into the indefinite or diffuse nebulous forms shewn by other instruments in a general manner, and either exhibits configurations altogether unimagined, or resolves perhaps the nebulous patches of light into clusters of stars. Guided in the general researches by the works of the talented and laborious Herschels—to whom astronomy and science owe a deep debt of gratitude—time has been economized, and the interests of the results vastly enhanced. So that many objects in which the fine instruments of other observers could discern only some vague indefinite patch of light, have been brought out in striking, definite, and marvellous configurations.

Among these peculiar revelations is that of the *spiral* form—the most striking and appreciable of all—which we may venture to designate "*The Rossean Configuration.*" Its discovery was at once novel and splendid; and in reference to the dynamical principles on which these vast aggregations of remote suns are whirled about within their respective systems and sustained against interferences, promises to be of the greatest importance.

One of the most splendid nebulæ of this class—the *great spiral* or *whirlpool*—has been figured in the Philosophical Transactions for 1850. It may be considered as the grand type and example of a class; for near 40 more, with spiral characteristics, have been observed, and about 20 of them carefully figured. Dr. Scoresby had the pleasure of being present at the discovery of this particular form in a nebula of the planetary denomination, in which two portions following spiral forms were detected. Its color was peculiar,—pale blue. He had the privilege, too, of being present on another interesting occasion, when the examination of the great nebula in Orion was first seen to yield decisive tokens of resolution.

In these departments of research, the examination of the configurations of nebulæ, and the resolution of nebulæ into stars, the six-feet speculum has had its grandest triumphs, and the noble artificer and observer the highest rewards of his talents and enterprise. Altogether, the quantity of work done, during a period of about seven years,—including a winter when a noble philanthropy for a starving population absorbed the keenest interests of science,—has been decidedly great, and the new knowledge acquired, concerning the handiwork of the Great Creator, amply satisfying of even sanguine anticipations.

Dr. Scoresby found, in September last, that about 700 catalogued nebulæ had been already examined, and transferred to the ledger records from the journals of the Observatory, (comprising only a selection from the general observations,) and the *new nebulæ*, or nebulous knots, discovered merely incidentally, amounted to 140 or more. The number of observations, involving separate sets of the instrument, recorded in the ledger, (exclusive of very many hundreds, possibly thousands, on the moon and planets,) amount to nearly 1700, involving several hundreds of determinations of position and angular measurements with the micrometer on the far distant stars. The carefully drawn configurations, eliciting *new characteristics*, exceed 90, and the rough or less finished sketches amount to above 200. Of the 700 catalogued nebulæ already examined, it should be observed, that in full one-half or more, something new has been elicited.

In speaking of the effects of the flood of light accumulated by the six-feet speculum of the Earl of Rosse, Dr. Scoresby remarked, that this peculiarity of the instrument (connected as it is with due length of focus and admirable definition) enabled it to reach distances in space far beyond the powers of any other instrument. This was its peculiar province; and in this, as to existing instruments, there was not, nor, as he hoped to shew, could there be, any competition. For comparing the space-penetrating power of the six-feet speculum with one of two feet (which has rarely been exceeded) we find it three to one in favor of the largest, with an accumulation of *light* in the ratio of 6^2 to 2^2, or 9 to 1. On comparing the powers of this magnificent instrument with those of a refractor of two feet aperture, the largest hitherto attempted, we have a *superiority*—making a due allowance for the loss of light by reflection from two mirrors, and assuming an equal degree of perfectness, figure, and other optical requirements in the refractor, and *no* allowance for absorption of light—in the ratio of about 4·5 to 1, as to light, and as 2·12 to 1, as to the capability of penetrating space, or detecting nebulous or sidereal objects at the extreme distance of visibility. Hence, whilst the range of telescopic vision in a refractor of two feet aperture would embrace a *sphere* in space represented by a diameter of 2; the six-feet speculum (assuming both instruments to be of equal optical perfection, magnifying equally, and allowing fifty per cent. for loss of light for two reflections in the one case, and none (?) in the other) would comprehend a sphere of about 4·24 diameter,—the outer shell of which, 1·12 in thickness, being the province of the great instrument alone. But let us reduce those proportions to *sections* of equal spaces, that we may judge more accurately of the relative powers. Now, the solid contents of different spheres, we know, are in the ratio of their diameters. Hence the comparative spheres, penetrated by the two instruments referred to, should be $4·24^3$ to 2^3; that is, as 9·5 to 1. Deducting, then, from this vast grasp of space the inner sphere, capable of being explored by other instruments, we find that, out of nearly ten sections of space reached by this telescope, there are nearly nine sections which the six feet speculum may embrace as peculiarly its own!

What its revelations yet may prove, then, we can have no idea. Several thousands of nebulæ have been catalogued: the great

* An abstract of a lecture delivered at Torquay, November 15, 1852.—From the Edinburgh New Philosophical Journal for January, 1853.—Sill. Jour.

reflector might add to these tens of thousands more. But this, seeing how few nights in a year are favorable for the highest powers, must be the work of years of perseverance. It would be a worthy undertaking for the government of a great country, to afford the means of multiplying such gigantic instruments. Application is to be made, in this direction, for a six-feet reflector at the Cape of Good Hope, for the examination of the heavens towards the southern pole. Lord Rosse, with his usual nobleness of liberality, will yield up his laboratory, machinery, and men, to the service of government, and is willing, mereover, to give the direction and guidance of his master-mind. Will the British nation be content with a refusal?

The range opened to us by the great telescope at Birr Castle, is best, perhaps, apprehended by the now usual measurement—not of distances in miles, or million of miles, or diameters of the earth's orbit, but—of the progress of light in free space. The determination, within, no doubt, a small proportion of error, of the parallax of a considerable number of the fixed stars, yields, according to M. Peters, a space betwixt us and the fixed stars of the smallest magnitude, the sixth, ordinarily visible to the naked eye, of 130 years in the flight of light. This information enables us, on the principles of *sounding the heavens*, suggested by Sir W. Herschel, with the photometrical researches on the stars of Dr. Wollaston and others, to carry the estimation of distances, and that by no means on vague assumption, to the limits of space opened by the most effective telescopes. And from the guidance thus afforded us, as to the comparative power of the six feet speculum in the penetration of space, as already elucidated, we might fairly assume the fact, that if any other telescope now in use could follow the sun if removed to the remotest visible position, or till its light would require 10,000 years to reach us, the grand instrument at Parsonstown would follow it so far, that from 20,000 to 25,000 years would be spent in the transmission of its light to the earth. But in the cases of clusters of stars, and of nebulæ exhibiting a mere speck of misty luminosity, from the combined light perhaps of hundreds of thousands of suns, the *penetration* into space, compared with the results of ordinary vision, must be enormous; so that it would not be difficult to shew the *probability* that a million of years, in flight of light, would be requisite, in regard to the most distant, to trace the enormous interval.

But after all, what is all this, vast as the attainment may seem, in the exploration of the extent of the works of the Almighty? For in this attempt to look into space, as the great reflector enables us, we see but a *mere speck*—for SPACE IS INFINITE. Could we take, therefore, not the tardy wings of the morning, with the speed of the mere spread of day, nor flee as with the leaden wings of light, which would require years to reach the nearest star, but, like unhampered *thought*, could we speed to the farthest visible nebula at a bound,—there, doubtless, we should have a continuance of revelations; and if bound after bound were taken, and new spheres of space for ten thousand repetitions explored, should we not probably find each additional sphere of telescopic vision garnished with suns and nebulous configurations rich and marvellous as our own? If these views serve to enlarge our conception of creative wonders, and of the glory and power of the Great Architect of the heavens, should they not deeply impress us in respect to the Divine condescension in regarding so graciously this little, inferior world of ours? Animated with the spirit of the Psalmist, we shall each one, surely, be disposed appropriately to join in his emphatic saying—"When I *consider* thy heavens, the work of thy fingers, the moon and the stars which thou hast ordained; what is man, that thou art mindful of him? or the son of man, that thou visitest him?"

On the Rising of Waters in Springs immediately before Rain.

By Prof. J. Brocklesby.*

My attention was particularly called to this phenomenon during the close of the summer of 1852, while residing a few weeks in Rutland, amid the highlands of Vermont. In the western portion of the town is a lofty hill, rising to the height of about four hundred feet above the Otter Creek valley. Near the summit of the hill a small spring bursts forth whose waters are conveyed in wooden pipes to the barnyards of two farm houses situated on the slope of the hill; the first being about one-fourth of a mile distant from the spring, and the second nearly one-third of a mile. At the latter house I resided. The waters of the spring are not abundant, and during the summer months frequently fail to supply the aqueduct. Such was the state of the spring when I arrived at Rutland; for the summer had been extremely dry, and the brooks were unusually low, and the drought had prevailed so long that even the famed Green Mountains had, in many places, began to wear a russet livery. The drought continued, not a drop of rain falling, when one morning a servant, coming in from the barnyard, affirmed that we should soon have rain, as the water was now flowing in the aqueduct, the spring having risen several inches. The prediction was verified, for within two or three days rain fell to a considerable depth.

In a short time the spring again sunk low, and ceased to supply the aqeduct; but one cloudless morning, when there were no visible indications of rain, its waters once more rose, flowing through the entire length of the aqueduct, and ere twenty-four hours had elapsed, another rain was pouring down. On inquiry it was ascertained from the residents in the vicinity, that the phenomenon was one of ordinary occurrence, and that for the last twenty years the approach of rain was expected by the rising of the spring.

Interested by these facts, I sought for others of a like nature, and requested through the public prints information on the subject from all who happened to possess it, and also upon collateral points which were conceived to have important relations to this phenomenon. I was rewarded by the knowledge of only one additional instance, existing in Concord, Massachusetts, where a spring that supplies a certain brook is said to rise perceptibly before a storm. Mr. Wm. Munroe, who lives near the stream, kindly offered the following information, which is given below in nearly his own words:—"Although I have frequently been informed that the Dodge's brook, (so called,) after a dry time, and when no water had run for some days, would begin again to run when the clouds threatened rain, but before a drop had fallen; yet I cannot say that I have ever taken much pains to investigate the fact. However, I perfectly recollect being at one time near the brook when there had been a long drought. The clouds threatened rain very soon—not a drop of water had run into the brook for some days—not a drop had fallen from the clouds, and no rain had occurred in the vicinity. The course of the brook is across the road, I was standing in the road watching the brook, and then saw a small stream in its bed flowing towards the river, which is about fifteen rods distant from the road; the spring that supplies the brook is situated about half a mile from the river, and is sometimes so powerful that I have known the brook to overflow the road for the space of several rods; I cannot say that it is an established fact that the river always rises before a rain, but I have good reason to suppose that it does." The preceding statements in respect to Dodge's brook are corroborated by the son of Mr. Munroe, who writes thus:—The subject has

* Proceedings of the American Association at Cleveland—Annals of Science.

not so far as we are aware, fallen under the notice of any close observer of the facts you enquire about, the most that is known being this—that the bed of the brook, during a long drought, having become dry, the stream is known to start again before a rain, and the belief is that rain is to be looked for immediately on the appearance of Dodge's brook." The cause of the phenomenon has been attributed by some to the fall of rain at the distant sources of the spring, a short time previous to their descent in the vicinity of the spring itself; but this view is doubtless erroneous, since it is altogether improbable that rain should fall at two different localities year after year with the same constant period of time between them, and that this interval should be such as to insure that water falling at the first locality should always arrive through subterranean channels at the second before the rain commenced. I have not been able to ascertain the state of the barometer, either at Rutland or Concord, at the times when the phenomenon in question occurs; nevertheless, I believe that the true solution will be found in the diminished atmospheric pressure which exists before a rain. The waters of a spring remain at any given level, because the atmospheric and hydrostatic pressures combined exactly counterbalance the upward force of the jet.—The spring will therefore rise, either when the force of the jet is increased while the atmospheric pressure continues the same, or when the latter is diminished while the former remains constant; and the elevation is greatest of all when the decrease in the pressure of the atmosphere occurs simultaneously with an increase in the strength of the jet. The rising of the water in the instances related, cannot, I think, in view of the facts detailed, be fairly attributed to any sudden augmentation of force in the current of the spring, but it is to be regarded as the result of diminished atmospheric pressure occurring at the particular times, in perfect accordance with known meteorological laws. I am not aware that it has yet been ascertained whether this phenomenon is local or general. If the latter should be found true, and the explanation given correct, we arrive at the curious discovery that the springs and fountains of the earth are natural barometers, whose indications may, perhaps, be worthy of notice iu future physical investigations.

INCORPORATED BY ROYAL CHARTER.

Canadian Institute.

Third ordinary meeting, Jan. 7, 1854.

The names of the following Candidates for Membership were read:

Lucius O'Brien, C. E., ... Toronto.
F. A. Whitney, ... Toronto.
J. W. G. Whitney, ... "
C. H. Jervis, ... "
Rev. E. St. John Parry .... "
Capt. C. R. Scholefield, ... "
J. Small, M. D., ... "
J. E. Small, ... "

The following gentlemen were elected Members:—

G. B. Holland, ... Toronto.
C. Hampden Turner, ... Rooks Nest, Surrey, Eng.
H. Bennett, ... Toronto.
E. Billings, ... Bytown.

The following pamphlets were presented to the Society by Mr. Henning:

Report and proceedings of the Standing Committee on Railroads, Canals and Telegraph Lines, Quebec, 1852.

Reports on the Sea and River Fisheries of New Brunswick.

Return of Sums paid by Government and correspondence relative to Railroads, 1853.

Geological Survey of Canada, 1852–'53.

Report of Special Committee on the Magdalen Islands, and Western part of this Province above Lake Huron, 1853.

The thanks of the Institute were given to Mr. Henning for his donation.

The annual address was then delivered by the President, after which Dr. Bovell read a paper, entitled 'Original Views on the Renal Circulation.

The President's Address.

Gentlemen of the Canadian Institute,

The duty which, by your appointment, falls at this time upon me, of saying something of the condition, objects, and prospects of this Association, is rendered much more agreeable than it might otherwise have been, by the prosperous state of its affairs as exhibited in the last report of the council.

The liberal spirit in which the Legislature has patronised your efforts at so early a stage; the ready and kind attention of the Executive Government to such requests and suggestions as have been made to them in connection with the objects of the Institute;—the great accession within the last year of new members, many of them gentlemen who from their position, public spirit, and scientific attainments may be expected to render you important service; the growing circulation of the useful and highly interesting Journal published by the Association; and the many valuable gifts of books, and of minerals, and other objects of interest in various departments of Natural History,—these circumstances have all combined to place the Institute, even at the present moment, in a position most gratifying to its members, while they afford grounds for very encouraging hopes as to its future usefulness.

But in venturing to draw from the past these flattering presages

of the future, we must not forget to make allowance for the advantages which we have lost in the departure from the Province of our late President, whose active and zealous services in behalf of the Association, have been so instrumental in bringing it to its present state.

It is not merely that his familiarity with rather a wide range of scientific subjects qualified him for taking much more than an ordinary part in the proceedings of the Institute; but his eager thirst for knowledge, his ardent devotion to the interests of science, his indefatigable industry, his strong religious sense of the obligation which we all lie under to the common family of mankind; and as much as all these, his hopeful turn of mind which made it always difficult for him to believe that any thing would be found to be impracticable by which a great public good might be attained;—these all made him an invaluable fellow-worker with you, especially in laying the foundation for your future system of proceeding. Some portion of his spirit inevitably communicated itself to those with whom he was associated, and thoroughly unselfish, and disinterested as he was seen to be in all his aims, he proved to be an efficient applicant on behalf of the Association whenever an occasion offered, being a suitor whom all were reluctant to disappoint, and all willing to oblige.

I need offer you no excuse, I am persuaded, for not suffering myself to be restrained by the domestic tie which exists between Capt. Lefroy and myself from paying this just tribute to his services—That circumstance has but given me a better opportunity than I should otherwise have had of appreciating his disposition and exertions. It can hardly, I believe, lead me to take a more affectionate interest in his reputation than will always be felt by those whom I am addressing.

It is abundantly evident, gentlemen, that the Canadian Institute, from the zealous efforts of several able and efficient supporters, is occupying at this moment a more considerable place in public estimation than it could have been expected to attain so early; but if we stop for a moment on the vantage ground that has been gained—to look round us, and to glance at the past as well as at the future, I believe we may come satisfactorily to the conclusion that if it shall be the good fortune of this Association to work out any important good for Canada, it still need not be seriously regretted by us that it did not begin its work sooner, or rather that such an Association was not sooner formed.

Many things seem to have occurred to render the time chosen for its commencement an auspicious starting point, and it will be more favorable perhaps to its future success that the Institute has had from the first a vigorous growth, and has occupied early a position recommending it to public countenance and favor, than that it should have been forced into existence before it could have found adequate support. It could only then have lingered in a sickly state, not attracting much attention nor giving rise to any sanguine hopes;—and it would have been more difficult to have infused life and energy into such an Institution, than at a fitting time to create a new one. Less competent, as I am, in other respects to form an opinion upon this point than many others who are present, I have the advantage of being able to judge perhaps more clearly, from actual observation, of the past condition of Upper Canada; and I do not believe that much time has really been lost, (if any has been,) in making this kind of effort for the advancement of science.

This is pretty well proved, I think, from the small success which was found to attend some exertions of a similar description, though less comprehensive in their character, which have, from time to time, been made in Upper Canada.

And here we may naturally ask ourselves whether it is, or is not, to the discredit of this country that up to this period more has not been done by voluntary efforts for the promotion of science, and more distinction gained in its pursuit? I should be glad to be able to prove, quite satisfactorily, that we lie under no peculiar reproach in that respect. At all events let the facts be fairly stated.

Two generations have passed away since a civilized people began to occupy Upper Canada;—our own Journal, in a late article full of interesting matter, informs us that for twenty years of that time we have had a population over 300,000—for ten years exceeding 500,000, and we may be certain that at present our numbers are beyond a million.—Upon the first impression it would seem, on a comparison with other countries, that, under such circumstances and in all this time, some native Canadian might have been expected to start from the canvas more distinctly than any has done;—that some one gifted with peculiar powers would have gained for himself a name likely to endure, and would have conferred celebrity upon the country of his birth, by some striking discovery in art or science, or at least by a proficiency in some liberal pursuit, that would have attracted general attention, and established even abroad a deference to his name as an authority.

We might refer to some other countries, particularly in the North of Europe, where, in communities not so populous, there have, from time to time, arisen men so distinguished by the gifts of genius, and by the use they made of them, that their names have been handed down from age to age, and are regarded now with a veneration scarcely diminished by the splendid modern discoveries which have disproved some of their theories, and rendered useless many of their inventions.

But we must consider, on the other hand, that these men have generally flourished in older communities than ours; that the discoveries made, and the distinction obtained by many of them, were the fruits of a "learned leisure," which in Upper Canada hitherto scarcely any have enjoyed; and, besides, that these shining lights have commonly appeared at distant intervals in the course of centuries, with larger spaces of time perhaps between them than would cover our whole history as a people.

The more rapid and general spread of knowledge, too, has had the effect in our time of placing educated men upon more equal ground in regard to their attainments; so that a striking elevation is not so easily gained. And there has been another more formidable impediment peculiar to our condition as a new country, for Upper Canada may still be called such, though it is fast losing any claim to particular allowance upon that score—I refer here to the fact that among the million who now inhabit this upper portion of the Province, even those who came hither in mature years from other countries, with minds highly cultivated, have, with very few exceptions, been unavoidably engaged like the multitude around them, in the anxious labor of some profession or employment, by which their daily subsistence was to be earned. Those born in the country have had their time and their thoughts equally engaged by efforts to gain for themselves a competency which few have had the fortune to inherit from their fathers. And *so* it has happened, (though I think not entirely *so*) that Upper Canada, if I may assert this without

seeming to disparage any just claim to excellence, and distinction, can not yet be pointed to as the birth place of any who have won for themselves the celebrity that waits on genius successfully cultivated, nor perhaps even of any who have greatly signalized themselves by an enthusiastic devotion to art or science. When I hesitate to say that we can wholly and clearly ascribe this want, which I think we must acknowledge, to the influence of any or all of the causes that I have mentioned, it is because I can not forget that in other countries we do see, every now and then, starting up, as if to relieve the monotony of life, poets, philosophers, mathematicians, mechanics, linguists, artists, whose very existence has seemed bound up in some one particular pursuit, who, under every disadvantage of position—oppressed by want—disheartened at times by neglect—unaided by instruction, and having access to no advantages which may not be enjoyed here, have worked their way to eminence, and have made their names like house-hold words, likely to endure to the end of time—men

> Whose honors with increase of ages grow
> As streams roll down, enlarging as they flow.

I suppose after all, the solution is that we must look upon these prodigies as the gifts of GOD vouchsafed to a Country when he thinks fit; and that in the order of Providence, the day of Upper Canada has not yet come—for we must say of genius, as the Poet has said of taste,—

> —This nor gems, nor stores of gold
> Nor purple state, nor *culture* can bestow
> But GOD alone, when first His active hand
> Imprints the secret bias of the soul.

It will not, however, I trust be long before Canada will have her sons whom future generations will have a pride in remembering, for as respects her political condition, and the public provision made for instruction, such is her actual state, and such the prospects of the future which are opening upon us that we can scarcely name a country of which it can be said that those who are to be born in it will have fairer opportunity and freer scope, for the cultivation and use of their intellectual faculties.

We can not, it is true, hope for many years, or, should I not rather say, for many ages, to possess seats of learning which can rival the time-honored universities of the United Kingdoms; but in what portion of the British Empire is instruction more accessible to all?—I mean instruction to such an extent as is necessary for developing and cherishing any latent spark of genius, or discovering the germ of any peculiar talent, and for facilitating the early progress of youth in the pursuit of any science to which their nature may particularly incline them.

Throughout a large portion of Upper Canada, and in many entire Counties, the difficulties of a first settlement in a thickly wooded Country have been overcome by the patient though tedious and toilsome labour of the axe-man, for which the inventions of science have not yet provided a substitute. The second and third generations of farmers are now occupying fertile lands, cleared by the toil of those who have gone before them. Very many of these are in comfortable circumstances, able to appreciate and enjoy the advantages of education, and not without the ambition to improve them, and to ascend to positions among their fellow-men, which, in Canada, as in other portions of the British Empire, are open to all. Our commerce, too, expanding with the rapid and enormous increase of our productions is accumulating wealth—and wealth brings leisure. We shall soon have a larger class of men among us who, having succeeded to something more than a bare competency, or having secured an independence by their own exertions will be exempt from the daily toil which is the common lot; and some of these we may hope will be inclined to devote themselves to the pursuits of Science, and to encourage and assist the efforts of others.

The current literature of the day now circulates as freely and almost as cheaply in Upper Canada as it can do any where. The system of education in the Common Schools, extended as it is to the remotest parts of the Province, brings instruction within the reach of almost every household. The formation of public Libraries in connection with this system; the multiplication of grammar schools; the establishment of Colleges fully adequate in number to the wants of the Province; and the formation in most of our large towns of Mechanics' Institutes, all show a population alive to the importance of intellectual culture; and I believe those who have acquired experience in Europe and in Canada in the business of instruction, will not hesitate to declare that there is no want of good natural capacity in the Canadian youth.

What useful part may be taken by this Association in encouraging a taste for Scientific pursuits, is in some measure foreshadowed in the numbers of the Canadian Journal.

Besides the papers read and discussed here by members, which form, properly speaking, the proceedings of the Institute, we find collected in the Journal, and presented in a convenient form, notices of important discoveries in the Arts and Sciences, and discussions of various scientific questions, which have engaged the attention of learned bodies, or of individuals possessing a profound knowledge of the several subjects, and the advantage of every aid which the most favorable circumstances could supply.

Some of these discussions relate to questions which are not of a nature to be affected by any peculiarities of situation or climate, but have an universal interest, so that the truths which may be ascertained, and the results arrived at, are useful in one country as well as in another. Others may turn upon particular diversities arising from local causes, and may from that very circumstance furnish grounds for useful comparison. It is a great advantage to have such facts, and the reasoning upon them collected and presented in a convenient form, unmixed with political and other controversies of a merely temporary interest, and unincumbered with the crowd of advertisements which swell the bulk of daily and weekly newspapers. In a Country, too, which is advancing by such rapid strides in population and wealth, and which is making such remarkable exertions to procure for itself the advantages which till lately were confined to older and more opulent communities, it is deeply interesting to collect and preserve for future comparison and reference, the history of its developement. Those who come after us will feel that no light obligation has been conferred upon them by the Association which has taken the trouble of recording the first movements made in our great public enterprises, thus enabling them to see the time and manner of originating them, and to compare the predictions of their promoters with the results which have followed. Again, the early history of our settlements; the gradual growth of our towns and cities; the increased and improved quality and the varying proportions of our agricultural productions;—the unforseen turns which the trade of Canada will have taken under the freedom of intercourse permitted to her; the extension and improvement of our navigation; the stupendous railway undertakings; the introduction and growth of manufactures; and what is really more important than all, the developement of civil and religious institutions; upon all, or most of these points the pages of the *Canadian Journal* may be made the means of disseminating and preserving much valuable information,—as I think we may say they have already done, in regard to several of the subjects which I have alluded to. Some of these, though they

refer to facts and topics of great public interest, may not (except in their bearing upon questions of political economy) be considered to come within the range of Science, which has been defined to be "Art, attained by precepts, or built on principles," and they may not come directly within any of the objects specified in the first section of the regulations of the Canadian Institute, yet information upon them cannot but be useful and welcome to the public, and in disseminating such information by the circulation of the Journal, the Institute will be felt to be rendering a valuable service, and a service to science, in that wider sense by which it may be understood to comprehend every species of knowledge. For valuable papers relating to several of the physical sciences, we shall, I hope, continue to be indebted to a class of gentlemen who made, indeed, the first movement towards the establishment of the Institute. I mean the Civil Engineers, whose profession compels them, in the study and practice of it, to look below the surface of things; to devise new applications of mathematical principles, and mechanical powers, and to consider and make allowance for the great laws of Nature: for it is upon her mysterious and unerring laws that many of their operations are founded. We may expect too, that their opportunities of research, and their habits of observation, will lead to valuable contributions being made to our museum of mineralogy, and to the study of geology among us. We can not indeed, presume to say what description of physiological researches may not receive some assistance from the cause I allude to, for there is such an affinity between the several branches of natural Science, that there is always a prospect of good, especially in a large and imperfectly explored country like this, from any circumstance which sends abroad among the works of Nature a number of men whose minds have been turned and trained to the observation of her laws, and who have been accustomed to reason and to act upon what is known concerning them.

In connection with some of the speculations and studies of natural philosophers, Canada will always present a very interesting field from the circumstance that a large portion of it to the northward, while it is even now easily accessible by means of its numerous chains of lakes and rivers, and is becoming every year more so from the nearer approaches of railways, yet from its inaptitude for cultivation, continues, and is likely to continue in its primitive state, exhibiting to the lover of nature, and to the inquirer into her works, her romantic woods, rocks and rivers, her shrubs, mosses, insects, and all her wonders, animate and inanimate in their aboriginal state, undisturbed and unaffected by the operations of man.

It will be felt, I think, in future times, to be a great charm of this country that nature, on so vast a scale, can be seen in all her majesty and freshness, by so ready and easy a transition from a contiguous territory, populous and fertile, and abounding in all the comforts and advantages of civilized life.

It is, perhaps, no disadvantage that I have little space left, without wearying you, to say any thing of the future prospects of the Canadian Institute, for in speaking of the future we must be dealing, more or less, in uncertain speculation.

The degree of success which has been obtained in so short a period of time, gives at least good encouragement; and as I have already stated, the attempt for gaining some foot-hold for scientific discussion, seems to have been made at a juncture very favorable.

The public mind is at present little distracted by angry political discussions—there has been a long period of tranquility which may create stronger confidence in the stability of our Colonial relation. The greater activity of trade, and greater abundance of capital arising from various causes, occasion Canada to be more looked to than formerly as a country presenting advantages for the profitable investment of money.

The progress which is being made in the construction of railways (there being now, in Upper Canada, nearly 400 miles of rail-way in use, where ten months ago there was not one mile completed,) must inevitably give to the Province a very different position in the estimation of other countries, and cannot fail to have a great effect in attracting to it men of liberal minds and means. There must be many, no doubt, who not having been under any absolute necessity of emigrating, are yet very sensible that they might find it to their advantage in doing so—but have been deterred from taking the step so long as they must have submitted to the many discomforts and disadvantages inseparable from bad roads and the consequent difficulty of access to market. Men of cultivated minds, and accustomed to social comforts and enjoyments, will, in future, hesitate less to disperse themselves freely over all portions of this new country, when a few hours travelling, unattended by fatigue or discomfort, will transport them to and from the large towns. Such persons will soon be able, without subjecting themselves to any severe privation, to make their choice of a place of residence in Canada, according to their preferences of climate or soil, or proximity to lakes or rivers, or guided by the price of land, or by the description of settlers whom they would choose for neighbors, or by any other predilections—for it will be in their power to consult their peculiar tastes—without condemning themselves to exclusion from what others are enjoying.

The tendency of this great change, to people Upper Canada more generally, and in more equal proportion, with a class of educated men, is an advantage by which such an institution as this can hardly fail to profit. And I believe, without meaning to disparage any advantages which other colonies may present that we may expect to gain no inconsiderable degree of wealth and intelligence from a re-action which seems inevitable, of that movement which of late years has been carrying such multitudes to the Australian Colonies. It has seemed as if the sacrifice of the lives, and health and fortunes of thousands were necessary to produce a conviction of the rather obvious truth that the circumstance of gold being among the natural productions of a country, does not ensure the acquisition of wealth, nor even of independence to all who can make their way to it,—but that, on the contrary, it has a tendency to place many, if not most, of those in a false and distressing position, who rush thither in the eager spirit of adventure.

Now that so many are returning with disappointed hopes, many more must be warned by their example not to run so perilous a hazard; and of those who have rational motives for seeking new homes, but may hesitate hereafter to wander to countries so remote, upon very doubtful prospects, we may expect to have the pleasure of receiving our fair proportion; and whatever may be the accession of intelligence that may accrue to the country from this cause, some portion of that gain, I trust, will be felt by the Canadian Institute.

In contemplating any extension of the labors and objects of this Association, and considering in what additional manner or degree it may be made to contribute to the advantage and enjoyment of those who have leisure and inclination to indulge in scientific pursuits, we must find ourselves at once embarassed by the want of a suitable building belonging to the Institute in which its proceedings can be carried on, and its library and museum accommodated and arranged with a due regard to order and convenience. This want, too, we must apprehend, may soon press with greater force than at present, since it is uncertain how long we can be permitted, by the kind consideration of the government, to occupy the spacious, and, in some respects, con-

venient building which we are now in. Perhaps a careful examination of what we might reasonably hope to be able to accomplish, might convince us that we need not long delay taking measures for providing for the Institute a permanent home of its own.

There are many reasons which should stimulate us to make such an effort; but it may be safely left to the Council to consider the proper time and manner of proposing it.

I owe it to myself, gentlemen, not to conclude without assuring you that if due credit had been given to my earnest protestations of unfitness, I should not now have been found inadequately filling a place, of which the duties could be much better discharged by many whom I see about me. I beg, therefore, that you will be just enough to make this allowance for me; that I am here by no fault of mine; for I am but too conscious that I have the least possible pretensions to Science, excepting whatever knowledge I may have gathered in the course of a long application to one particular science which I apprehend may not be universally in favor. In the regulations first promulgated by the Council, I saw it stated "that there were three classes of persons who might with propriety join the Institute." In the first of these I was well aware that I could not claim a place. In the second class, which was stated to consist of "those who may reasonably expect *to derive some share of instruction* from the publication of your proceedings in the Journal," it seemed to me that I might be included;—and perhaps also in the third, which was defined as consisting of "those who, although they may neither have time nor *opportunity* for contributing much information, may yet have an ardent desire to countenance a laudable, and, to say the least, a patriotic undertaking." I confess I was amused by observing the delicate tact with which the framer of these regulations substituted in his description of the third class the word "opportunity" for "*ability*," which was plainly in his mind, but being willing to understand and accept the word in its hidden sense, I ventured to enter by a door so widely and considerately opened, but I entered it only for the purpose of receiving instruction, not with any idea of communicating it.

Original Views on the Renal Circulation.

Dr. Bovell commenced by showing the unanimity of opinion on the injurious consequences resulting from detention of the solid elements of the urinary secretion, and the readiness of the conversion of those bodies into other compounds, such as urea, ammonia and oxalic acid, &c. The experiments of Dr. Lethby on the passage of arsenious acid through the renal circulation, and the detection of the poison in the urine, were next dwelt on, as well as the recent experiments of M. C. Bernard, these latter specially going to prove a ready exit for watery portions of the blood through the kidney. Finally, Dr. Bovell brought forward several cases of Bright's disease, to support the opinion advanced in the paper, viz: that the malphigian tufts, said by Mr. Bowman and others to secrete the water of the urine, were the true renal secerning apparatus, and that the water of the urine was supplied by the venous plexus of the tubuli uriniferi. We are very glad to be able to state that Dr. Bovell's views on this most important subject will shortly be printed for the use of the Members of the Institute in pamphlet form.

Alphabetical List of the Members of the Canadian Institute.

Names.	*Residence.*
Adamson, Rev. W. A., D.D.	Quebec, C. E.
Allan, G. W.	Toronto, C. W.,
Ambrose, Alex. P.	Grimsby, "
Armour, A. H.	Toronto, " King street.
Armstrong, W.	" " Queen "
Arnold, John	" " Peter "
Badgley, Prof. F.	" " Bay "
Baker, Hugh C.	Hamilton "
Baldwin, Hon. Robt	} Spadina, near Toronto, C. W.
Baldwin, W. W	} Spadina, near Toronto, C. W.
Baldwin, Robt., Junr.,	} Spadina, near Toronto, C. W.
Baldwin, W. A	" "
Baldwin, M. S	Toronto. C. W., Duke street.
Barclay, Rev. J	" " Wellington street.
Barron, F. W.	" " U. C. College.
Bartlett, Rev. T, H.M.	Kingston, "
Barwell, Lewis	Brantford, "
Beaven, T. F	Toronto, " Spadina Avenue.
Beaven, E. W	" " Trinity College.
Beard, Chas	Woodstock"
Becher, H. C.R	London, "
Bell, Rev. Andrew	L'Original,"
Bell, Rev. George	Simcoe, "
Bethune, Prof. N	Toronto, " Richmond street.
Bird, James	Peterboro, "
Blackie, John	Danville, C. E.
Black, James	Ayr, C. W.
Bleasdell, Rev. W	Trenton, "
Bogert, J. J	Toronto, " Trinity College.
Boomer, A. K	" " King street.
Boulton, W. S	London, "
Boulton, Hon. H. J	Toronto, C. W., Wellington street.
Bovell, Prof. James	" " King street.
Bristow, Arthur	Weston, "
Brondgeest, J. T	Toronto, "
Brown, Geo., (M. P. P.)	" "
Browne, George	Montreal, C. E.
Brown, John	Thorold, C. W.
Browne, J. O	Toronto, " York street.
Brunel, Alfred	" " Bond "
Buckland, Prof. G	" "
Burke, J. N	Stanfold, C. E.
Cameron, Peter	Toronto, C. W.
Cameron, J. M. A	" "
Cameron, Hon. Malcolm	Quebec, C. E.
Cameron, John	Toronto, C.W., Com. B'k., Willm st.
Cameron, Angus	" " Mon't Bank, Yonge st.
Cameron, Col K	Beavertou, C. W.
Campbell, Major T. E	St. Hilaire, C. E.
Campbell, Judge E. C	Niagara, C. W.
Carruthers, F. F 4	Toronto, "
Cayley, F. M	" "
Chapman, Prof. E	" "
Cherriman, Prof. J. B	" " Observatory.
Clark, John	Port Dalhousie, C. W.
Connor, Skeffington, L.L.D.	Toronto, " Bay street
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Cotton, James	Toronto, " Church street
Craigie, Doctor W	Hamilton, "
Crawford, D	Toronto, " Jarvis street
Crease, Lieut., R. Engineer	Quebec, C. E.
Crease, G	Toronto, C. W.
Croft, Prof. H	" " Gerard street.
Crombie, E. M	" " George "
Cronyn, Rev. B	London, "
Crooks, Adam	Toronto, "
Cull, E. L	" "
Cumberland, F. W	" " Duke street.
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Dartnell, G. H	} Toronto, C. W., Peter street
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Dennis, J. S.	Weston, "
Deslandes, P. F. C	Toronto, " Pine Hurst.
Devine, Thomas	Quebec, C. E.

Dexter, Armory..........Cobourg, C. W.
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Drummond, A.......... " "
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Duggan, John.......... " " Bay street.

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Ellis, John.......... " " King street.
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Esten, J. H..........Toronto, " St George's Sqr.
Ewart, John, Junr.......... " " Yonge street.

Feehan, D. K.......... " " Front street.
Ferrie, Robert..........Doon "
Fitzgerald, W. W..........Toronto, "
Fitzgerald, W. J.......... " "
Fleming, S.......... " " Richmond st.
Flesher, W. K..........Artimesia "
Forrest, J. W..........Hamilton, "
Fowler, Henry..........Toronto, " Yonge street.
Freeland, Patrick.......... " " Church street.
Fripp, H. G. R.......... " " Yonge street.

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Gibb, Doctor G. D..........Montreal, C. E.
Gibson, David..........York Mills, C. W.
Good, James..........Toronto, " Queen street.
Grant, John..........Whitby, "
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Hall, James..........Peterborough, "
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Haycock, T. H..........Chippewa, "
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Henning, Thomas.......... " " " "
Heyden, L.......... " "
Heyden, L. Junior.......... " "
Hind, Prof., H. Y.......... " "
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Hincks, Rev. Prof. W..........Toronto, C. W.
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Hodgins, Thos.......... }
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Hutcheson, John.......... " " Church street.

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Jameson, Hon. R. S.......... " " " "
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Jones, W..........Port Stanley, C. W.
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Lawson, Walter..........Sarnia, "
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Lowe, F. C..........Toronto, C. W., Wellington street.
Lyons, James..........Hamilton, C. W.

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Moffatt, Lewis.......... " " " "
Morrison, J C., M. P. P.......... " "
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McDonald, Don. Jr.......... " "
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Northcote, Henry - - - - - -Toronto, C. W., King street.

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O'Brien, R. L. - - - - - - -Toronto, "

Palmer, E. J. - - - - - - - " "
Pardey, W. H. - - - - - - - " "
Parker, David - - - - - - -Sarnia, "
Parkes, Vincent - - - - - -Toronto, "
Parr, Richard - - - - - - -Chatham, "
Passmore, F. F. - - - - - -Toronto, " King street.
Patrick, Alfred - - - - - - " " John street.
Pell, J. E. - - - - - - - " " King street.
Perram, J. - - - - - - -Tecumseth, "
Perkins, Frederick - - - - -Toronto, " Peter street.
Philbrick, Prof., C. J. - - - Yorkville, "
Phillips, T. D. - - - - - - -Toronto, " Trinity College.
Primrose, Doctor Francis - - - " " Richmond street.
Prosser. T. C. - - - - - - -Bolton, Albion, C W.
Pyper, W. - - - - - - - -Toronto, C.W., C'l B'k., William st.

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Richardson, Prof. J. H. - - - -Toronto, C. W., Bay street.
Richards, Hon. Justice - - - " "
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Robinson, W..........Norwich, C. W.
Robinson, Christopher..........Toronto, " Beverly House.
Robinson, J. Lukin.......... " " Peter Street.
Rothwell, Richard.......... " " Trinity College
Rowsell, Henry.......... " " King Street.
Rubidge, F. P..........Quebec, C. E.
Rutherford, E. H..........Toronto, C, W., Bay Street.
Ruttan, Henry..........Cobourg, "
Ryerson, Rev. Doctor E..........Toronto, " Bay Street
Rykert, G. Z..........St Catharines, C. W.
Rykert A. E..........Toronto, " Trinity College

Sabine, Col. E. R. Artillery..........Woolwich England
Salter, A. P..........Chatham, C. W
St. George, H. Q..........Whitchurch, "

Sangster, John	Hamilton, "	
Savigny, H. P.	Barrie, "	
Scadding, Rev. Doctor H.	Toronto, "	U. Can. College
Schoefield, W. A.	Bentick, "	
Sears, S. B.	Chatham, "	Or Buffalo.
Shanly, Walter	Toronto, "	Wellington Stree
Shanly, Francis	" "	Bay Street.
Shier, John	Whitby, "	
Simons, T. M.	Hamilton, "	
Simpson, A. W.	Cobourg, "	
Sladden, W.	Toronto, "	
Small, Rev. J. W.	" "	York Street.
Smallwood, Doctor	Isle Jesus, C. E.	
Smith, William	Glanford, C W.	
Sootheram, G. H.	Toronto, C.W.,	B.B N.A., Yonge St.
Spragge, Hon. J. G. (Vice Chan'r.)	" "	Portland Street.
Spratt, Robert	" "	
Spreull, Samuel	" "	61½ Yonge Street.
Stark, David	Montreal, C. E.	
Stephenson, Robert (M.P.)	England.	
Stevenson, James Jr.	Hamilton, C. W.	
Stewart, G. A.	Toronto, "	
Storm, W. G.	" "	
Stratford, Doctor S	" "	Yonge Street.
Strathy, G. W.	" "	Bond Street.
Street, R P.	Gore Bank, Hamilton, C. W.	
Street, T. E.	Niagara Falls, "	
The Right Rev. Lord Bishop of Toronto,	"	Front street.
Thomas, W.	Toronto, C. W.,	Church Street.
Thomas, C P.	" "	"
Thomson, E. W.	" "	
Thomson, C. E.	" "	Trinity College.
Torney, Hugh	" "	
Unwin, Charles	Toronto, C. W.	
Valentine, J S.	Niagara, "	
Vidal, Capt. Alex.	Sarnia, "	
Walsh, F. L.	Simcoe, "	
Walsh, Robert	Lloydtown, "	
Walker, E. A.	Barrie, "	
Weller, W. H.	Cobourg, "	
Wells, Robert	Toronto, "	
Wells, R. M.	" "	
Wheeler, Thomas	" "	King Street.
Whittemore, E. F.	" "	Bay Street.
Whitwell, Rev. R.	Phillipsburg, C. E.	
Widder, Fred'k.	Toronto, C. W.	
Willis, Rev. M., D D.	" "	
Wilkinson, J. A.	Sandwich, "	
Wilson, Prof. Daniel	Toronto, "	
Woodruff, S. D.	St. Catharines, C. W.	
Worthington, Thomas	Wellington, P. E. District, C. W.	
Worthington, John	Toronto, C. W.,	Temperance Street.
Worts, J. G.	" "	
Wright, James	" "	City B'k. Church St.
Wyllie, G. B.	" "	King Street.

HONORARY MEMBERS—FOUR.

Lefroy, Capt. J. H.; R.A., F.R.S.	Sabine, Col. E., R.A., F.R.S., &c.
Logan, W. E.; F.R.S. and G. S.	Stephenson, Robert (M.P.)

LIFE MEMBERS—EIGHT.

Cotton, James	Hincks, Hon. F.
Duggan. George Junr.	Hutcheson, John
Duggan, John	Jamieson, Hon. R. S.
Herrick Doctor G.	Parkes, Vincent.

JUNIOR MEMBERS—TWENTY-NINE.

Baldwin, Robert	McGregor, C. J.
Baldwin, M. S.	Northcote, Henry.
Beavin, T. F.	O'Brien, L. R.
Beavin, E W.	Ridout, Charles
Bogert, J. J.	Ridout, Charles
Crease, G.	Rothwell. Richard
Crumbie, E M.	Rykert, A. E.
Dartnell, G. H.	Simpson, A. W.
Davies, H.	Thomas, C P.
Esten, J H	Thomson, C. E.
Fitzgerald, W. W.	Torney, Hugh
Hallen, H. S.	Wells, R. M.
Heyden L (Junior)	Wright, James
Moberley, W.	Phillips, T. D.
Murney, E. H.	

Honorary Members,	4
Life Members,	8
Junior Members,	31
Members,	239
Total,	282

JAMES JOHNSTON,

Assistant Secretary,

CANADIAN INSTITUTE

12 December, 1853.

Ordered by the Council to be presented to the Annual General Meeting, Dec. 17th, 1853.

ELECTED ON THE 7TH JANUARY, 1854.

Bennett, Henry	Toronto.	C. W.
Billings, Elkanah	Bytown,	C. W.
Holland, G B.	Toronto.	C. W.
Turner, C. H.	Rooks nest, Surry, England.	

ELECTED ON THE 14TH JANUARY, 1854.

Whitney, F. A.	Toronto.
O'Brien, L. R.	"
Whitney, J W. G,	"
Jervis. C. H	"
Parry, Rev. E St John	"
Scholefield, Capt. C. R.	"
Small, J., M. D,	"
Small, J. C,	"
Total Members,	282+12=294

ERRATA.—Page 119.—After F. W. Cumberland, last line from the bottom of the page, insert:—The gentlemen whose names are given in the above certificate were balloted for, and duly elected, Dec. 3d, 1853

Correspondence.

The following is the letter of Dr. Wilson, which accompanied his donation of Minerals to the Institute—recorded in the November number of the Journal.

PERTH, 6th Nov., 1853.

SIR,—

On account of professional duties I have not been able to send a few minerals for the museum of the Canadian Institute before this time; I have packed a small box with specimens for this purpose, addressed to you, paid the freight, and sent it off to day by way of Brockville, and trust it will reach you in good order. The specimens are not of such a character as will attract the attention of those who collect minerals for the sake of their beauty; but they may be of some little use to the scientific enquirer. The specimens are all numbered, with which the following list will agree, and also give their names and localities :—

No.	Name	Locality.				
No. 1.	Raphelite	Tp. of Lanark,	3d Con. park lot, No. 7			
" 2	Perthite	" N. Burgess,	6th Con. lot No. 3.			
" 3.	Peristorite,	" Bathurst,	9th	"	"	19.
" 4.	Bytownite,	" Drummond,	6th	"	"	2.
" 5.	An unknown mineral	" North Burgess,	9th	"	"	2.
" 6.	Tremolite,	" Bathurst,	12th	"		
" 7.	Labradorite,	" "	9th	"	"	19.
" 8.	Anthophylite and Satin Spar	" North Burgess,	6th	"	"	4.
" 9.	Asbestos,	" Dalhousie,	3rd	"	"	15.
" 10.	Sphene, Pyroxene, &c.	" Elmsley.	8th	"	"	
" 11.	Shorl.	" Bathurst,	4th	"	"	13.
" 12.	Black Spinell	" Bathurst,	1st	"	"	10.
" 13	Compact, Dolomite,	Town line bet. N. Sherbrook and Palmerston opposite No. 18 and 19 in N. Sherbrook.				
" 14.	Granular Dolomite.	Tp. of Dalhousie,	10th Con., lot No. 8.			

" 15.	Ferruginous Silicate of Manganese - -	"	Lanark, 2nd Con., lot No. 2 town lot.		
No. 16.	Copper Ore, - - -	"	N. Burgess	9th Con , lot No. 2.	
" 17.	Serpentine, containing Corundum -	"	N. Burgess,	8th "	" 2.
" 18.	Magnetic Iron Ore,	"	S. Sherbrook,	3rd "	" 18 & 16.
" 19.	Graphite - - - -	"	S. Burgess,	2nd "	" 3.
" 20.	An unknown mineral	"	Dalhousie,	5nd "	
" 21.	Weathered specimens of Perthite - -	"	N. Burgess,	6th Con., lot No. 3.	

The specimens marked 1, 2, 3, 4 have been characterized by the late Dr. Thomas Thomson, Professor of Chemistry in the University of Glasgow, as new species. Although the Doctor has been a powerful leader and contributor to chemical science for more than forty years, yet his decisions concerning these minerals have been denounced by Mr. Hunt, Chemist to the Geological survey of this province, as altogether erroneous. In the Geological report for 1847 and 1848, Mr. Hunt says that the Perthite of Dr. Thomson is "nothing more than a reddish felspar;" that from the Doctor's analysis it would appear that this mineral. unlike other felspars, contains no potassium, which is, according to him, replaced by calcium: and it was upon this chemical difference, principally, that he predicated its distinctness as a species. It has, however, been analyzed by my pupil, Mr. Hartly, in the laboratory of the survey, and the results shew that it contains both potassium and sodium, and is indeed quite similar in composition to other felspars." I have no apparatus fit for delicate analysis; but if I had and were ever so capable, would feel no small reluctance in venturing to dispute Mr. Hartley's investigations, but would be inclined to put more confidence in Doctor Thomson's statements than in Mr. Hunt's pupil. In October, 1849, I was favored with a letter and special messenger from B. Silliman, Junr., in which he says, "I propose to make some new analyses of the minerals described by Dr. Thomson as new species, and will feel particularly indebted to you for authentic specimens of them" I sent the Professor the specimens he wanted and begged that he would favor me with the results of his analysis. In his reply he says: "I am unable at present to give you my own opinions of the species; I have, however, put them into the hands of my brother-in-law, Mr. Dana. who is now preparing for the third edition of his mineralogy, to be issued next spring, and they will get justice done them" It is only lately I got a chance of seeing the third edition of Dana's Mineralogy, and do not observe that it gives any new analysis of these minerals—it refers the reader to the Canadia authorities, Mr. Hartley and Mr. Hunt. for information. I am sorry to observe in this book that even the localities of the minerals are not correct—it gives the locality of Perthite and Bytownite as being in Bathurst, and they are several miles distant from the township. Since my correspondence with Professor Silliman, I have got Mr. Logan's report for 1850 and 1851, wherein Mr. Hunt again declares Dr. Thomson's decisions incorrect, and when speaking of the Perthite, he says: *The colors of this felspar become much darker by exposure to the action of the weather*, the analytical results which follow were obtained from freshly broken *light colored fragments*, and the mineral rendered, &c., &c. Mr. Hunt was with me at the locality of the Perthite, examined the surface of the rock and the mineral in situ with apparent attention, and, after having done this, how he can state that this mineral becomes darker by exposure to the action of the weather is very extraordinary. Whenever the mineral is exposed to the weather, it becomes of a light color, and, in some places, bleached almost white; such light colored specimens, must be partially decomposed, and therefore unfit for giving by analysis, the several constituents of the mineral. The specimens marked ‡ were taken by me from the surface of the rock where they were exposed, to the weather, and will speak for themselves. Mr. Hunt further observes that "the quantity of Potash present in, and the extensive deposit of this felspar, are such as make it worthy of attention, as an economical source of this alkali, which in proportion as wood becomes scarce, is increasing in value so much as to make its extraction from its mineral constituents a source of profit." Now, as this mineral is only to be found mixed up with a kind of granite which occupies a bit of surface no more (the proprietor of the land informs me) than four acres, these four acres must afford a very great quantity of potash indeed, or the demand must be very small, if it will yield a sufficient supply when our woods are all gone—the process of extracting the alkali, too, from the rocks, must be less expensive and less laborious than it is at present. Possibly this is not the only locality of the felspar; but I have yet to learn whether this mineral has been found in any other place. The external characters of the Perthite differ from those of other felspars, and Mr. Hunt gives it no credit for being new on this account; yet says that a mineral he found in 1847, at the grand Calumet on the Ottawa, gives by analysis the same constitution as chlorite, the principle difference being in the proportion of water, and "that the hardness completely distinguishes it from chlorite, and constitutes it a new and distinct species." Thus it seems hardness, and other external or physical characters (independent of chemical analysis) are quite sufficient to confer on this mineral the dignity of a new species; whilst the Perthite (notwithstanding its peculiar external and physical characters) gets no credit for these, but is condemned to the plebeian rank of common falspar. Much can be said about Mr. Hunt's treatment of the other three minerals, but I feel I am encroaching on your time and patience. You will much oblige me by giving me your opinion of the red colored mineral, No. 5, and also of No. 20.

I am, Sir, your ob'dt. servant,

JAMES WILSON.

PROF. H. CROFT,
Corresponding Sec. Canadian Institute,
Toronto.

Notices of Books.

Letters from Egypt, Ethiopia and the peninsula of Sinai, by Dr. Richard Lepsius, with extracts from his chronology of the Egyptians, with reference to the Exodus of the Israelites. Revised by the Author; Translated by Leonara and Johanna B. Horner: p.p. 578, *London, Henry G. Bohn*, 1853.

Egypt and Ethiopia, still lands of mystery, notwithstanding all that has been thought, said and written respecting them, are partially unveiled to us in these interesting and erudite letters, coupled with the startling fact that the discoveries of Dr. Lepsius add not less than TWO THOUSAND YEARS to the generally assumed period of man's existence on earth, and place the period of the first Manethonic Dynasty between three and four thousand years before Christ. Not less interesting is the discovery of the true position of SINAI, which has been for so many centuries hidden as it were behind a cloud.

The origin of these letters is too interesting to be passed over without recognition, and before offering any illustrations of their varied contents, we will give the account of Dr. Lepsius's object of the expedition, and the means by which it was accomplished.

The object of the scientific expedition, which the King of Prussia sent to Egypt in the year 1842, was to investigate and collect, with an historical and antiquarian view, the ancient Egyptian monuments in the Nile Valley and upon the peninsula of Sinai.—It was fitted out and sustained for more than three years by the munificence of the King, and enjoyed uninterruptedly his gracious favour and sympathy—as well as the most active and kind attention from Alexander Von Humboldt, and by a rare union of fortunate circumstances—it attained the purposes they had in view as completely as could be expected.

We shall probably find space to give a more complete account of the results attained by this expedition in future numbers of the journal—let it suffice at present to present a few of the most striking.

The most important results we obtained, therefore, were in chronology and history. The Pyramid-fields of Memphis gave us a notion of the civilization of Egypt in those primitive times, which is pictorially presented to us in 400 large drawings, and will be considered in future as the first section in that portion of the history of man, capable of investigation, and must be regarded with the greatest interest.

Those earliest Dynasties of Egyptian dominion, now afford us more than a barren series of empty, lost, and doubtful names. They are not only free from every real doubt and arranged in the order and the epochs of time, which have been determined by a critical examination, but by showing us the flourishing condition of the people in those times, both in the affairs of the state, civil affairs, and in the arts they have received an intellectual and frequently a very individual historical reality. We have already mentioned the discovery of five different burial-places of the 6th Dynasty in central Egypt, and what we obtained from them. The prosperous times of the new monarchy, viz.: the period of splendour in the Thebaid as well as the Dynasties which followed, were necessarily more or less completed and verified. Even the Ptolemies, with whom we appear to be perfectly acquainted in the clear narratives of Grecian history, have come forward in a new light through the Egyptian representations and inscriptions, and their deficiences have been filled up by persons who were hitherto considered doubtful, and were hardly mentioned by the Greeks. Lastly, on the Egyptian monuments we beheld the Roman Emperors in still greater and almost unbroken series, in their capacity of Egyptian governors, and they have been carried down since Carracalla who had hitherto been considered as the last name written in hieroglyphics, through two additional later Emperors as far as Decius, by which means the whole Egyptian monumental history has been extended for a series of years in the other direction.

The following description, of a spectacle not uncommon in tropical seas, but one of which the eye never becomes wearied, will be read with interest. It occurred on the outward voyage of the expedition from Southampton, off the Spanish coast.

Page 37—"But now the most splendid spectacle presented itself that I have ever seen at sea. The ocean began to lighten up, all the crests of the breaking waves glowed with an emerald-green fire, and a brilliant greenish-white waterfall fell from the paddle-wheels of the vessel, which left in its long wake a broad light streak in the dark sea. The sides of the vessel, and our downward gazing faces, were lighted up as bright as moonlight, and I was able to read print without any difficulty by this water-fire. When the illuminating matter, which, according to Ehrenberg's researches, proceeds from infusorial animalculæ, was most intense, we saw flames dancing over the sea, as far as the coast, so that it seemed as if we were sailing through a more richly starred sky than that which was above us. I have frequently observed this illuminatton of the sea on the Mediterranean also, but never with such extraordinary brilliancy as on this occasion. The spectacle was quite like enchantment. Suddenly I observed between the waves new living streaks of fire, which radiated from the vessel like two gigantic serpents, and, judging by the proportions of the ship, were at least from sixty to eighty feet long; they moved in a deceptive manner, in large windings beside the vessel, crossed the waves, dipped into the foam of the paddle-wheels, re-appeared, retreated, hurried forward, and finally vanished in the distance. For a long time I could not explain this phenomenon. I thought of the old tales, so frequently repeated, of the huge sea serpents which have been seen from time to time. Nothing could more closely resemble what was here before us. At length it occurred to me that it might however, only be fishes running a race with the vessel, and, by their rapid movements, brushing the surface of the luminous sea, they might produce the long streaks of light behind them. Nevertheless, the ocular demonstration remained as deceptive as before; I could discover nothing of the dark fishes, nor determine their size; but I at length consoled myself by my own conjecture."

Thebes, the city of a hundred gates, the half explored and half understood wonder of the past, is described with much minuteness. A short extract we subjoin.

"We have now been inhabiting our Thebian Acropolis, on the hill of Qurna, above a quarter of a year, every one busily employed in his own way from morning to evening, in investigating, describing, and drawing the most valuable monuments, taking paper impressions of the inscriptions, and in making plans of the buildings; we have not yet been able to complete the Libyan side alone, where there are at least twelve temples, five-and-twenty tombs of Kings, fifteen belonging to the royal wives or daughters, and a countless number belonging to private persons still to be examined. The eastern side, with its six-and-twenty sanctuaries, in a certain degree of preservation, will however demand no less time, and yet, more has been done by previous travellers and expeditions in Thebes itself, especially by the French-Tuscan expedition, than in any other spot, and we have every where only compared and oompleted their labours, and not repeated them. We are also far from imagining that we have now by any means exhausted the infinite number of monuments; whoever follows us with new information, and with the results of more advanced science, will also find fresh treasures, and gain fresh instruction from the same monuments. I have always had a historical aim in view, and this has especially determined my selection of the monuments. Whenever I believed that I had attained what was most essential for this end I was satisfied."

"The royal temple of KARNAK, which was dedicated to the King of the Gods, embraces in itself the whole history of the Egyptian Monarchy. "All Dynasties emulated in the glory of having contributed their share to the enlargement, embellishment or restoration of this national sanctuary." It was founded by their first king, Sesurtesen I, under the 1st Theban Royal Dynasty, the 12th of Manetho, between 2600 and 2700 before Christ, and even now exhibits some ruins in the centre of the building, from that period, bearing the name of this King."

"But a far more splendid enlargement of the temple was executed in the fifteenth and fourteenth centuries, B.C., by the great Pharohs of the 19th Dynasty; for Sethos 1st, the father of Ramses Miamun, added in the original axis of the temple, the most magnificent hall of pillars that was ever seen in Egypt or elsewhere. The stone roof, supported by 134 columns, covers a space of 164 feet in depth, and 320 feet in breadth. Each of the twelve central columns is 36 feet in circumference, and 66 feet high beneath the architrave; the other columns, 40 feet high, are 27 feet in circumference. It is impossible to describe the overwhelming impression which is experienced upon entering for the first time into this forest of columns, and wandering from one range into the other, between the lofty figures of gods and kings on every side represented on them, projecting sometimes entirely, sometimes only in part.

"Every surface is covered with various sculptures, now in relief, now sunk, which were, however, only completed under the successors of the builder; most of them, indeed, by his son Ramses Miamun. In front of this hypostyle hall was placed at a later period, a great hypæthral court, 270 by 320 feet in extent, decorated on the sides only with colonades, and entered by a magnificent pylon. The principle part of the temple terminated here, comprising a length of 1170 feet, not including the row of sphinxes in front of its external pylon, nor the peculiar sanctuary which was placed by Ramses Miamun directly beside the wall farthest back in the temple, and with the same axis, but turned in such a manner that its entrance was on the opposite side. Including these enlargements, the entire length must have amounted to nearly 2000 feet, reckoning to the most southern gate of the external wall which surrounded the whole space, which was of nearly equal breadth. The later Dynasties who now found the principle temples completed on all sides, but who also were desirous of contributing their share to the embellishment of this centre of the Theban worship, began partly to erect separate small temples on the large level space which was surrounded by the above mentioned enclosure wall, partly to extend these temples also externally."

We shall conclude this notice with the description of the climate of Upper Egypt, and some of its curious results.

"In Upper Egypt, where it scarcely ever rains, it is totally different, especially with respect to all the monuments which are situated on the borders of the desert, out of reach of the annual inundation, and this is uniformly the case with the tombs, the richest storehouses for our knowledge of ancient Egyptian life, which in this country alone really fulfil their true destination by serving as an asylum against distruction and decay. The narrow district of the Nile annually recreated borders in its whole length on the wide, rocky, and petrifying desert. The towns and temples were therefore chiefly built on the boundary between the two, partly not to intrench upon the fertile ground, partly in order that the buildings should be upon a drier and more secure foundation. And thus in fact, we find the numerous temples and palaces in wonderful preservation, so far as they are not mutilated by the hand of man. Even the bricks made of Nile mud, and dried in the sun, apparently the most perishable material, have not unfrequently been preserved in the open air for thousands of years, in the form in which they were built up, and with their coating of plaster. A row of great vaulted halls, built entirely of Nile bricks, and partly covered in the inside with stucco, stands about the celebrated temple of the great Ramses, in Thebes. They date from the same period as the temple itself, the beginning of the thirteenth century before Christ. This is not alone testified by the architectonic plan of the building, but most irrefutably by the bricks themselves, which bear the name of Ramses Miamun stamped upon them as a mark of the royal manufacture. At that time, and earlier, during the whole of the 18th and 19th Dynasties, it was a very common practice to line the excavated rock-tombs with Nile bricks, and afterwards to paint upon the stucco, especially wherever the rock was friable, and was therefore hewn into a vaulted roof. But the same custom is sometimes found even in the earliest period of the Pyramids of Memphis. In enclosed places, not only the building material, but the colours, both upon the stone and the plaster covering, have almost without exception retained their original freshness and perfection; and also, very frequently, where they have been exposed to the open air. The peculiar incorruptibility of vegetable and even of animal matter is, however, still more astonishing. Our museums are filled with such remains. In the most ancient tombs of Memphis, a multitude of objects are found made of wood, such as sarcophagi chests, and boxes of all kinds, chairs, instruments, small ships, likewise grains of corn, and dried fruits, such as pomegranates, dates, the fruit of the Doum Palm, nuts, almonds, beans, grapes; also bread, and other food: besides cloth made of bast, a texture of reeds, papyrus, and an incredible quantity of linen. The countless number of mummies, also, are well known, which, though taken out of their tombs, still last for centuries with their skin and hair; also all mummified bodies of animals, with their furs and feathers; even the internal parts of the human body could there be embalmed for ever, and are still found in vases expressly designed for that purpose. This wonderful conservative property belonging to all ancient Egyptian objects, depends therefore chiefly upon the sky being without rain and the dry soil of the non-irrigated desert. But the country offered another marked advantage above other lands—namely, the greatest abundance of materials, especially adapted for all kinds of monuments.

The Canadian Journal Postage Free.

The Members of the Canadian Institute and the Subscribers to the Journal, will be glad to be informed that for the future no charge will be made for the transmission of the Canadian Journal through the Post to any part of Canada. We believe we are correct in stating that this boon has been obtained through the instrumentality of the Hon. Malcolm Cameron. Such an encouraging instance of the desire of the members of the Government to favour by every legitimate means the claims of Science and Literature, will surely induce increasing exertions on the part of those who wish to witness the progress of Canada in scientific and practical knowledge, keep pace with the increase of its commercial wealth and the extension of its political importance.

Second Trial of Newall's Railway Break.

The second trial trip on the East Lancashire Railway, for testing the efficiency of this break was more systematically conducted, and its results have been ascertained with greater accuracy.

A much larger train was used than on the present occasion, consisting of 10 carriages, besides the locomotive and tender, eight of which had breaks attached. Length of train, 86 yards; weight, 88 tons, exclusive of the passengers. Order of carriages attached to engine and tender:—1, Van with break; 2, second-class carriage with break; 3, composite carriage with break; 4, composite with break; 5, second-class carriage with break; 6 and 7, first and second-class carriages without break; 8 and 9, two composites, each with breaks; van with break. Of the nature of the apparatus it is only necessary to repeat that a shafting with connecting rods stretches along over the top of the entire train, from the elbow of the engine driver to the hand of the guard behind (with flexible joints and sockets to accommodate curves, expansions, or contractions of the train), and that it is in the power of either of these, or of any one servant on the train, whichever may have the greatest presence of mind, on the alarm of danger, to apply the whole of the breaks in a moment. The trial ground extended over the 30 miles of rail between Manchester and Blackburn; the experiments being seven with the new breaks, and two with the old breaks, for the sake of comparison.

First Experiment.—On a slight curve on a down incline of 1 in 532 at Within's-lane, between Ratcliffe and Bury, the speed attained when the fog signal for putting on breaks exploded, being 38 miles per hour —the train was brought to a complete stand in 218 yards. Rails rather slippery, owing to a fog.

Second Experiment.—On a level at the station at Bury. Speed 40 miles per hour. Train brought up in 100 yards: in other words, the train ran only 14 yards beyond its own length after the signal was given to put on the breaks.

Third Experiment.—On a descending gradient of 1 in 38, down the first part of the Accrington-bank, 21 miles north of Manchester. Speed 40 miles per hour. Train pulled up in 450 yards.

Fourth Experiment.—On lower portion of Accrington-bank, with a descending gradient of 1 in 40, speed 48 miles per hour. Train brought up in 371 yards. This experiment was regarded as highly satisfactory. The rails were rather slippery, and the weight of the engine was unfavourable to the experiment, the locomotive being a ponderous one, made for goods trains, and not having breakage power to the tender sufficient to stop itself on such an incline, a fact showing how much the engine had dragged at the train after the patent breaks had exerted force enough to have stopped it, was seen in the draw-bars of most of the foremost carriages being drawn out from 10 to 20 inches. It was a matter of surprise to some of the old servants accustomed to work trains down this bank that a train at such a speed could be stopped by any possible means.

Fifth Experiment.—On the straight and level run at the Blackburn station. Speed 48 miles per hour; rails dry. Train stopped in 172 yards.

To witness the last and following experiments the company had alighted and stood on the station platform. The train was taken a few miles back each time towards Accrington, in order that a very high speed might be attained. A fog signal on the rails at the middle of the station was the notice to apply the breaks.

Sixth Experiment.—Speed 40 miles per hour. Stopped in 138 yards, or about 14 seconds of time.

Seventh Experiment.—Speed 56 miles per hour. Stopped in 310 yards. (The actual distance run by this train was 328 yards; but, as the last 128 yards were on a decline of 1 in 110, the 18 yards were deducted for the sake of a comparison with the previous experiments, to allow for extra gravitation.)

Eight Experiment.—For this experiment two of the patent break wheel carriages were taken off, and two other carriages were substituted with the old or ordinary breaks. The train then came into the station at a speed of 42 miles per hour. There were two guards, and each applying a break, and the driver applying the break to the tender, the stoppage of the train was entrusted to these three. The train went a distance of 663 yards before a stoppage could be effected. Allowing 43 yards for the disadvantage of the slight incline, over the last 463 yards, the distance was agreed to be taken at 620. By a calculation made on the spot, it was held that, comparing the speed of this train with the previous one, it ought to have been stopped in 180 yards instead of 683. In other words, the balance in favour of the new break train, as compared with a train having ordinary breaks, was the difference between 180 and 620.

Ninth Experiment.—This was the last trial made, and it was agreed to try the train with one ordinary break in addition to the engine driver's break. Speed 40 miles per hour. Stopped in 861 yards; or, allowing 61 yards for extra gravitation after reaching the incline, the distance was taken at 800 yards.

Taking the last experiment in comparison with the sixth, we have two trains at equal speed (40 miles), and the one is brought to a stand by a single person with the new apparatus in 138 yards, while the other runs 800 yards before it is stopped by the exertions of two persons, the guard and driver. The scientific and practical men present, without exception, expressed themselves highly gratified with the results. Mr. Fairbairn said, without pledging himself after an inspection such as had now been afforded to an approval of every detail of the invention, he would say that, so far as he could see, it was a very successful one, and he thought it was likely to lead to a change that was not important to this company alone, but to the locomotion of the whole kingdom. It had one important feature—that it could throw the whole weight of compression by the breaks on every carriage and every wheel of the train at once.

It was stated that a train with the new apparatus had been on this line from the 15th September, travelling a total of 5,874 miles, and making 2,856 stoppages, without the machinery once getting deranged or requiring repair, and that the wheels of the carriages in the time were little worn, while those with the ordinary breaks would have been worn flat in places to an extent requiring 3-8ths of an inch turning off by the lathe, in diameter, to bring them round, or into shape again. The power of the breaks has been known on a level line to bring a train to a stand, in spite of the tractile power of the engine with full steam on. Another advantage observed was, that the new apparatus gives perfect communication between guard and driver, as the break need only be applied in a modified degree to attract the notice of either; or, if this was not enough, a bell attached would render the communication more complete. It has been suggested that, as there are periodical meetings of all the great railway authorities in London, their attention should be called to the new agent, and that the train might be sent up the London and North-Western line to enable them to test it.

Obituary.

Died, at his residence on Ann Street, December 7, Hugh Scobie, Esq.

The loss which Canada has sustained by the untimely death of this enterprising man, will be better understood if we enumerate a few of his works: He was Editor and Proprietor of the *Daily Colonist;* the *British Colonist;* the *News of the Week;* the *Canadian Almanac* (an edition of 40,000 copies); Publisher of the *Canadian Journal;* the *Municipal Manual* for Upper Canada; of numerous Charts of the Great Lakes; Plans of Cities and Towns; Maps of the Districts of Canada; Maps of the Western and Eastern Divisions of Upper Canada; and a large number of Educational Works. He was the third son of Captain James Scobie, of the 83rd Highlanders, and, at the time of his death, was only in his 43rd year. The citizens of Toronto manifested the well-merited esteem they entertained for the deceased when living, and their painful regret at his death, by closing their places of business during the progress of a very numerous procession, which attended his remains to the grave.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East October, 1858.

Nine Miles West of Montreal.

[BY CHARLES SMALLWOOD, M. D.]

*Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 ft.**

Day.	Barom: corrected and reduced to 32° Fahr. 6 A. M.	2 P. M.	10 P. M.	Temp. of the Air. 6 A. M.	2 P. M.	10 P. M.	Tension of Vapour. 6 A. M.	2 P. M.	10 P. M.	Humi'y of the Air. 6 A. M.	2 P. M.	10 P. M.	Direction of Wind. 6 A. M.	2 P. M.	10 P. M.	Velocity in Miles per Hour. 6 A. M.	2 P. M.	10 P. M.	Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; a cloudless sky by 0. 6 A. M.	2 P. M.	10 P. M.
1	29·626	29·447	29·423	42.5	59 0	46.6	.263	.338	.303	.92	.66	.93	S W b W	S S W	S W b S	4.51	0.50	Calm.			Cir. Str. 8.	Cum Str. 5.	Overcast.
2	·348	·346	·424	45.4	45.0	41.0	.292	.290	.253	.93	.93	.92	N E b E	N b W	W N W	0.87	7.67	9.37	0.606		Str. 10.	Rain c. 7.40 a.m	Rain.
3	·413	·405	·615	38.0	45.0	36.1	.232	.241	.210	.94	.76	.91	W N W	W N W	W b N	16.30	15.00	15.00	0.666		Rain.	Cir. Str. 5.	Clear.
4	·574	·537	·483	38.0	52.7	47.8	.236	.326	.313	.94	.81	.93	S W b W	S W b W	S W	2.61	2.25	3.25	0.444		Light rain.	Str. 10.	Light Showers.
5	·423	·261	·186	51.0	53.0	51.0	.337	.341	.374	.87	.83	.96	S	S	S W b W	5.00	9.19	5.16	0.366		Cum. Str. 10.	Cum. Str. 10.	Rain.
6	·518	·435	·540	40.0	41.0	36.1	.250	.201	.205	.95	.73	.86	W N W	W N W	W N W	15.64	24.16	25.81			Rain.	Str. 9.	Cir. Str. 10.
7	·679	·658	·672	34.0	47.7	41.1	.178	.212	.217	.83	.69	.79	W N W	W N W	W b N	19.84	14.81	6.25			Str. 2.	Clear.	Str. 10.
8	·542	·542	·508	42.2	62.2	49.0	.243	.421	.312	.85	.75	.86	S S W	S W	S	Calm.	1.17	Calm.			Clear.	Clear.	Str. 10.
9	·222	·240	·266	51.7	69.5	53.1	.361	.414	.315	.92	.58	.76	W b S	S S W	W S W	1.65	4.62	3.72	0.100		Cum. Str. 2.	Clear.	Cir. 2; Th. storm
10	·377	·358	·395	39.1	50.8	37.1	.225	.274	.199	.79	.79	.83	W	W N W	W b N	3.17	5.37	0.53			Clear.	Str. 2. [& hail	Str. 6. [at 4.45
11	·473	·469	·520	38.0	42.5	38.1	.226	.263	.226	.91	.92	.91	W b N	W N W	W b N	1.39	13.14	18.05	Inap.		Clear.	Str. 4 ; Shower	Str. 9.
12	·488	·410	·420	37.0	45 6	42.6	.201	.253	.243	.86	.80	.85	W b N	W	W	14.40	12.06	15.00			Str. 8.	Cir. Str. 2.	Hazy.
13	·395	·386	·549	40.5	45.8	40.8	.245	.253	.227	.92	.80	.85	W N W	N W	N W	21.73	9.98	8.45	Inap.		Rain.	Cir. Str. 2.	Str. 8.
14	·663	·632	·765	36.7	51 5	35.5	.210	274	.203	.91	.70	.91	N W	N W bW	W	0.38	0.67	2.12			Clear.	Str. 2.	Clear.
15	·740	·621	·654	36.0	59.2	47.0	.210	.358	.291	.91	.70	.86	S W b S	S W b W	W S W	0.22	8 21	2.51			Clear; hoar fr.	Cir. Str. 7.	Clear.
16	·736	·662	·561	38.0	63.6	47.0	.218	.411	.291	.87	.71	.86	W b S	W S W	S S W	0.25	1.37	1.02			Clear.	Clear.	Clear.
17	·581	·543	·650	44.6	55.9	41.0	.282	.385	.235	.92	.84	.85	W S W	W N W	N W	2.62	6.75	2.71			Clear.	Cir. St. 4.	Clear.
18	·746	·679	·685	32.0	55.4	43.0	.182	.295	.233	.91	.66	.79	N W b N	W N W	W b S	0.67	5.06	3.05			Clear.	Clear.	Light Cir.
19	·690	·611	·651	37.2	63.7	50.0	.218	.366	.283	.91	.63	.75	W b N	W S W	W b S	5.31	4.08	6.25			Clear.	Clear.	Clear.
20	·651	·621	·586	43.6	67.0	50.8	.252	.480	.326	.85	.72	.87	W b S	S W	S W	7.81	2.00	1.75			Clear.	Clear.	Clear.
21	·577	·491	·439	44.6	55.9	54.2	.282	.418	.373	.92	.87	.94	E	E N E	E b N	Calm.	0.91	3.52			Clear.	Clear.	Str. 10.
22	·372	·211	·128	49.0	66.2	63.2	.336	·605	.546	.98	.94	.94	E	S b E	S b E	2.95	1.95	9.00	1.126		Rain c. 3.4 a.m.	Cum. Str. 9.	Rain at 7 p.m.
23	·207	·292	·388	51.0	57.5	44.0	.315	.316	.241	.81	.66	.79	S W	W b S	W b S	5.21	17.50	7.65	0.433		Str. 4.	Cir. Str. 5.	Clear; Aur. Bor.
24	·247	·428	·248	38 8	41.8	32.2	.196	.235	.182	.76	·85	.91	W b N	N E b E	N N E	1.78	0.62	7.50	0.430	2.00	Str. 9.	Str. 10; Rain at	Snow at 6.30p.m
25	·113	·115	·391	33.0	40.5	32.7	.187	.210	.187	.90	.79	.90	W b N	W b S	W	17.75	17.03	17.00	0.286		Cir. Str. 8.	Clear. [2.25 p.m	Clear.
26	·610	·415	·498	33.0	45.3	41.0	.161	.272	.235	.78	.86	.85	S S W	S S W	S	9.61	4.25	7.07			Overcast.	Str. 10.	Str, 10.
27	·357	·359	·526	41.0	48.0	39.0	.262	.302	.214	.96	.86	.84	S	W b S	N W bW	6.68	5.87	3.88	1.006		Rain.	Str. 10.	Clear.
28	·465	·455	·563	35.0	41.5	29.5	.203	.201	.131	.91	.73	.70	N N E	N	N W	1.01	2.63	3.93			Str. 9.	Cir. Str. 4.	Clear.
29	·724	·730	·786	26.5	40.9	28 5	.108	.210	.117	.66	.79	.65	N W	W b N	W b N	3.32	9.30	2.85			Cear.	Clear.	Clear.
30	·853	·805	·720	24.1	42.0	32.0	.115	.178	.153	.76	.63	.76	W b N	W S W	S b E	Calm.	0.76	0.12			Clear.	Str. 2.	Overcast.
31	·629	·504	·463	31.5	52.2	40.0	.171	.283	.210	.89	.70	.79	S	S	S b W	0.92	3.85	6.25			Clear.	Cir. Str. 2.	Clear.

Barometer.
- Highest, the 30th day 29.853
- Lowest, the 25th day 29.113
- Monthly Mean, ... 29.500
- " Range 0.740

Thermometer
- Highest, the 9th day . . . . . 69.°5
- Lowest, the 30th day . . . . . 23.°0
- Monthly Mean . . . . . . 43.°37
- " Range . . . . . . 46.°5

Greatest Intensity of the Sun's Rays—138.°0

Lowest point of Terrestial Radiation 21.°0

Mean of Humidity, 855.

Amount of Evaporation, 2.31 inches.

Rain fell on 11 days amounting to 5.463 inches, and was accompanied by thunder and lightning on 2 days.

Thunder and lightning on 2 days.

Snow fell on the 24th day, amounting to 2.00 inches.

Most Prevalent wind—W. N. W.

Least do. do. E.

Most Windy Day—the 6th day—mean miles per hour 21.87.

Least Windy Day—1st day—mean miles per hour 0.456.

Aurora Borealis visible on 1 night, and might have been seen on 17 nights.

The electrical state of the atmosphere has been marked by moderate intensity of a positive character, and during the storm of the 9th day, indicated a High Tension of the same character.

* *This Table was accidentally omitted in the November number. The Tables for Toronto, and St. Martin, and Quebec, will appear as usual in the next issue.*

The Canadian Journal.

TORONTO, FEBRUARY, 1854.

Preliminary Account and Results of the Expedition of Dr. Richard Lepsius to Egypt, Ethiopia, and the Peninsula of Sinai.*

In the year 1842, in accordance with the proposal of Eichhorn, at that time Minister of Instruction, and at the recommendation of M. M. Alexander, V. Humboldt, and Bunsen, his Majesty King Frederic William 4th, of Prussia, determined to send a scientific expedition to investigate the remains of ancient Egyptian and Ethiopian civilization still in preservation in the Nile valley and the adjacent countries. The direction of the undertaking was entrusted to me, after the detailed plans of the proposed expedition had been minutely examined by the Royal Academy of Sciences, and in all points graciously approved by the King.

The land-surveyor, G. Erbkam, from Berlin, and the draughtsmen and painters, Ernest and Max Weidenbach, from Naumberg, and J. Frey, from Basle, were appointed to make the drawings and colored representations, as well as those architectonic plans, which had to be executed on the spot. When J. Frey was obliged to return to Europe from Lower Egypt, on account of the injurious climate, he was replaced by the painter O. Georgi, from Leipzig. Two English artists, also J. Bonomi, who, from the interest he took in the journey, became attached to our party while we were in London, and the architect J. Wild, who joined us of his own accord, took an active part in the expedition as long as it remained in Lower Egypt. Lastly, during nearly the whole of the journey we enjoyed the society of the present Counsellor of Legation, H. Abeken, who accompanied us voluntarily and on an independant footing, and who in various ways promoted the antiquarian objects of the journey. We were also provided with the means of obtaining plaster casts of those representations that were best qualified for the purpose, by the addition of Franke the moulder.

The different members of the expedition arriving by various roads, met in Alexandria on the 18th September, 1842. On the 9th November we encamped near the great Pyramids of Gizeh. What we obtained on that spot as well as from the adjoining Pyramid fields of Abusir, Saqara, and Daschur, which are situated to the south, occupied us exclusively and uninterruptedly for more than six months. The inexhaustible number of important and instructive monuments and representations which we met with in these Necropoli, the most ancient that have existed in any country, surpassed every expectation we had been entitled to hold concerning them, and accounts for our long abode in this part of the country, which is the first approached and visited, but has, notwithstanding, been very little investigated. If we except the celebrated and well known examination of the Pyramids in the year 1837, by Colonel Howard Vyse, assisted by the accomplished architect Perring, little had been done to promote a more minute investigation of this remarkable spot; the French-Tuscan expedition in particular did little more than pass through it. Nevertheless, the innumerable tombs of private individuals grouped about those royal Pyramids, partly constructed of massive square blocks, partly hewn into the living rock, contain, almost exclusively, representations belonging to the old Egyptian Monarchy, which terminated between two and three thousand years before Christ; indeed, most of them belong to the fourth and fifth Manethonic Dynasties, therefore between three and four thousand years before Christ. The wonderful age of these Pyramids, and of the surrounding tombs, is no longer generally denied by intelligent enquirers, and in the first volume of my "Egyptian Chronology," which has lately appeared, I have endeavoured to furnish a critical proof of the certain foundations we possess for a more special determination of time as far back as that period. But were any one only to believe in the lowest acceptation of modern scholars concerning the age of the first Egyptian Dynasties, he would still be compelled to yield priority to those monuments before any other Egyptian remains of art, and generally before all artistic remains belonging to the whole race of man, to which we can historically refer. It is only to this that we can attribute the wonderful growth in the interest which we attach partly to the monuments themselves, as proofs of the earliest activity shewn in art, partly to the various representations of the manner of living in those primitive times.

On the western border of the desert, which stretches from the most northerly groups of Pyramids at Abur Roasch, past the ruins of the old capital of Memphis, to the Oasis-peninsula of the "Faium," we discovered the remains of sixty-seven Pyramids, which with a few exceptions, were only destined for kings, and in the neighbourhood of the principal groups we investigated still more minutely 130 tombs of private individuals, which deserve to be more particularly recorded. A great many of these sepulchral chambers, richly adorned with representations and inscriptions, could only be reached by excavations. Most of them belonged to the highest functionaries of those flourishing Dynasties, among whom were also thirteen princes and seven princesses.

After we had taken the most careful topographical plans of all the fields of the Pyramids, and had noted down the architectonic ground plans, and sections of the most important tombs, and after we had, in the most complete manner, drawn or taken paper impressions of their pictures and inscriptions, as far as they were accessible to us, we had accomplished more completely than we ever hoped to do, the first and most important task of our journey, since we had acquired a basis for our knowledge concerning the monuments of the oldest Egyptian Monarchy.

On the 19th May, 1843, we proceeded still farther, and encamped on the 23rd in the Faium, upon the ruins of the Labyrinth. Its true position was long ago conjectured; and our first view dissipated all our doubts concerning it. The interesting discovery of the actual site of the ancient Lake Moeris was made about the same time, by the distinguished French architect Linant, which we had the opportunity of confirming on the spot. This greatly facilitated the means of comprehending the topographical and historical conditions of this province, so remarkable in all its features. The magnificent schemes which converted this originally desolate Oasis into one of the most productive parts of Egypt, were intimately connected with each other and must have belonged, if not to a single king, still to one epoch of time. The most important result we obtained by our investigations of the Labyrinth and of the adjoining Pyramids, was the determination of the historical position of the original founder; this we obtained by excavations which occupied a considerable time. We discovered that the king, who was erroneously called Mœris by the Greeks, from Lake Mere, (*i. e.,*) from the Lake of the Nile inundation, lived at the end of the 12th Manethonic Dynasty, shortly before the invasion of the Hyksos, and was called Amenembe by Manetho Amenemes the third of his name. His prede-

* Extracted from "Letters from Egypt, Ethiopia, and the Peninsula of Sinai," by Dr. Richard Lepsius.

cessors in the same Dynasty had already founded the town of Crocodilopis, in the centre of the Faium, which is proved by some ruins that still exist belonging to that period; and they probably conducted the Nile Canal, Bahr-Jusef, which branches off from Derut-Scherif, into the basin of the desert. That part of the basin which is most advanced and situated highest, terminated in a lake formed by means of gigantic dams, many of which still exist; and the connection of the canal was regulated by sluices in such a manner, that in the dry season the reserved water could flow back again into the valley of the Nile, and irrigate the country around the capital long after the Nile had retreated within its banks. Amenemhe built his Pyramid upon the shore of the lake, and a splendid temple in front of it. It afterwards formed the centre of the Labyrinth whose many hundred chambers, forming three regular masses of buildings, surrounded the oldest portion, and according to Herodotus, were destined by the Dodecarchs for the general diets. The ruins of the Labyrinth had never yet been correctly represented, not even in their general arrangement. An Arabian canal, which was carried through it at a later period, had drawn away the attention of passing travellers from that portion of the chambers which was in best preservation. We have made the most exact ground plan, accompanied by sections and views. A journey round the province, as far as Birqet-el-Qorn, and beyond it, to the ruins of Diméh and Qasr Queun, induced us to remain several months in this neighbourhood.

On the 23rd August we embarked at Beni-suef, visited a small rock temple of King Sethos 1st, at Surarieh, on the eastern shore, and farther on the remains of later monuments in the neighbourhood of Tehneh. At Kum-ahmar, a little to the south of Zauiet-el-meitin we examined a series of nineteen rock-tombs belonging to the 6th Manethonic Dynasty. The group of tombs which are scattered about a few days' journey to the south, at Schech-Said, El-Harib, Wadi-Selin, and still farther on, at Qasr-e-Saiat, also belonging to this period, which, in point of age, was immediately connected with the flourishing time of the great builder of the Pyramids. If we judge by the remains now extant, it appears that there were, at that early period especially, in this portion of Central Egypt a number of flourishing cities. Royal kindred are frequently met with among the ancient possessors of the tombs, but no sons or daughters of the king, because there was no royal residence in that neighbourhood. But we found the last flourishing period of the old Monarchy, the 12th Manethonic Dynasty, represented in this part of Egypt by the most beautiful and most considerable remains. The rock-tombs of Beni Hassan, so remarkable for their architecture, as well as for the various paintings on their walls, peculiarly belong to this period. The town to which they appertained, the residence of a governor of the eastern province, has entirely disappeared all except the name, which is preserved in the inscriptions. It appears that it only flourished a short time during this Dynasty and again declined at the invasion of the Hyksos. In the neighbouring Berscheh also, and farther on, among the Lybian rocks, behind the town of Siut, which was as important 4000 years ago as it is at present, we again found the same plans of tombs on as magnificent a scale, whose period of erection might be recognised even at a distance.

It is a singular fact, that in point of age the greater proportion of the remains of the Egyptian monuments become more modern the higher we ascend the Nile valley, the reverse of what might have been expected from a large view of the subject; according to which the Egyptian civilization of the Nile valley extended from south to north. While the Pyramids of Lower Egypt, with the monuments around them, had displayed the oldest civilization of the 3rd, 4th, and 5th Dynasties in such wonderful abundance, we found the 6th Dynasty, and the most flourishing period of the 12th, the last of the old Monarchy, especially represented in Central Egypt. Thebes was the brilliant capital of the new Monarchy, especially of their first Dynasties, surpassing all other places in the number of its wonderful monuments, and even now it offers us a reflection of the splendour of Egypt in her greatest times. Art, which still created magnificent things even in its decline, under the Ptolemies and the Roman Emperors, has left considerable monuments behind it, consisting of a series of stately temples in Dendera, Erment, Esneh, Edfu, Kum-Ombo, Debod, Kalabscheh, Dendur, Dakkeh, which are all, with the exception of Dendera, in the southern part of the Thebaid, or in Lower Nubia. Lastly, those monuments of the Nile valley which are situated most to the south, especially those of the "Island" of Meroe, are the latest of all, and most of them belong to the centuries after the Christian era.

We hastened immediately from the monuments of the old Monarchy in central Egypt to Thebes, and deferred till our return the examination of the well-preserved, but modern temple of Dendera, the ruins of Abydos, and several other places. But of Thebes also, we took but a preliminary survey, for we only remained there twelve days, from the 6th to the 18th of October.

We were impatient to commence immediately our second fresh task, which consisted in the investigation of the Ethiopian countries, situated higher up the river. The French-Tuscan expedition did not go beyond Wadi Halfa; Wilkinson's careful description of the Nile land and its monuments, which contains so much information, only extends a little higher up, as far as Semneh. The most various conjectures were still entertained concerning the monuments of Gebel, Barkal, and Meroe, with reference to their age and their signification. It was necessary to obtain a general view of the true relation between the History and civilization of Egypt and Ethiopia, founded upon a complete examination of the remains which are still extant. Therefore, after a cursory visit to the temple ruins, as far up as Wadi Halfa, we returned to Korusko, from which place we started on the 8th of January, 1844, through the great desert to Abu-Hammed, and the upper Nile countries, on the 16th of January we arrived at Abu-Hammed, on the other side of the desert; on the 28th, at Begerauieh, near to which the Pyramids of Meroe are situated. From Schendi, which lies more to the south, we visited the temple ruins of Naga and Wadi e Sofra, far on in the interior of the eastern desert. On the 5th of February we reached Chartum at the confluence of the White and the Blue Nile. From this place, accompanied by Abeken, I descended the Blue River, passed the ruins of Soba and Sennar, as far as the 13° of N. Lat.; whilst the other members of the expedition returned from Chartum to the Pyramids of Meroe. The tropical countries of the Nile, when contrasted with those northern ones devoid of rain, extending south as far as the 17°, and the plants and animals now almost exclusively confined to South Ethiopia, when compared with individual representations of the ancient Egyptian monuments, were rendered still more interesting by the discovery of some monuments, with inscriptions upon them, near Soba, by which we obtained traces of the ancient vernacular language of those districts in a written character resembling the Coptic.

I also made use of our residence in these districts to be instructed by the natives of the adjacent countries in the grammar and vocabulary of their languages.

On the 5th of April, I returned with Abeken to the other members of the expedition at Begerauieh. After drawings had been made of all that still existed which peculiarly represented

the state of civilization in Ethiopia, and after we had taken the most exact plans of the localities, we proceeded in six days, by the desert Gilif to Gebel Barkal, where we arrived on the 6th of May. Here was the more northern, the more ancient, and, to judge by the remains, also the more important capital of the state of Meroe. At the foot of this single mass of rock, which rises in an imposing manner, and is called there, in the hieroglyphical inscriptions, "The Sacred Mountain," is situated Napata. The history of this place, which we may still derive from its ruins, gives us at once a key to the relations which subsisted in general between Ethiopia and Egypt, as regards the history of their civilization. We find that the most ancient epoch of art in Ethiopia was purely Egyptian. It is as early as the period of the great Ramses, who, of all the Pharaohs, extended his power farthest, not only towards the north, but also towards the south, and testified this by monuments. At an early period he built a great temple here. The second epoch begins with King Tahraka, also known as the ruler of Egypt, the Thirhaka of the Bible. This spot was adorned with several magnificent monuments by him and his immediate successors, and though they were built in a style now employed by native kings, it is, nevertheless, only a faithful copy of the Egyptian style. Lastly, the third epoch is that of the kings of Meroe, whose dominion extended as far as Philæ, and was manifested also at Gebel Barkal by numerous monuments. On an intermediate journey into the Cataract country, situated farther up the river, which we had cut off by the desert journey, I found only middle-age, but no ancient Ethiopian remains of buildings.

(*To be continued.*)

Atmospherical Electricity.

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If we allow ourselves to be instructed by the analogies of the friction electrical machine, the Leyden jar, or the voltaic battery, we shall find that the essential condition for maintaining a charge of electricity, is the existence of two bodies or portions of the same body (which are generally conductors) separated from each other by a non-conducting medium. An electrical charge implies the presence of two bodies in opposite electrical states; and the well-known attraction mutually exerted by two such bodies would lead soon to a discharge, if they were not separated by the insulating medium. There is no reason why the solid earth should not play the part of one of these bodies, while the other is represented by the upper regions of the atmosphere or by the clouds floating therein. As the surface of the solid earth is separated from the region of clouds by the non-conducting air, an electrical charge may be maintained by the earth on the one hand, and by the clouds on the other, and this charge will be limited in intensity only by the dryness of the intervening air. Thus the whole earth resembles a Leyden jar, or more exactly, on account of the large distance between the clouds and the earth, an electrical machine, in which the rubber is moved from the prime conductor by a larger space than that which separates the two coatings of the jar, and in which, therefore, the electricity is more free than in the jar.

Observation shows that this electrical charge which the planet is capable of sustaining, it generally does sustain to a greater or less degree. As every change in the condition of matter, whether mechanical, physical, or chemical, places it in the electrical state—as heat, both directly and by leading to combustion and evaporation, provokes this electrical state.—We are at no loss for exciting agents which shall give to the earth and clouds the whole or a part of the electricity which they are designed to hold.

I shall consider,—1. The ways in which the electrical state of the atmosphere is investigated. 2. The results to which this investigation conducts. 3. The probable causes of atmospherical electricity. And 4. The effects, or the phenomena occurring in meteorology or elsewhere which originate in electrical action.

One way in which the electrical state of the air is examined is by erecting a metallic rod, insulating it from its supports, pointing it at the top, and connecting the lower end with an electrometer. It was on such a rod, erected at Marly-la-Ville according to the directions of Franklin, that Coiffier, the servant of Dalibard, first obtained by a premeditated experiment sparks of atmospherical electricity such as were anticipated from Franklin's prediction. Sometimes the apparatus well known under the name of "the electrical chime of bells" is attached to rods, which have been elevated either for the purpose of studying or of guiding atmospherical electricity, and, by the peal which it sends forth when the electricity descends, this secret of nature is betrayed to all within hearing of the sound, and the attention of the observer is called to his duty. Murray speaks of seeing a set of these electrical bells attached to a lightning-rod near a gateway in Zug, the capital of the Canton, and another in a garden on the route from Zurich to Basle.

When it is desired to make experiments upon greater heights than can be reached by rods, Saussure proposed to throw a ball into the air by means of an arrow or otherwise. A fine wire was attached by one end to this ball, and was carried up with it. The other end was connected with an electrometer. A long wire suspended from a balloon may be used for the same purpose, as was done by Gay-Lussac and Biot, in their celebrated scientific excursions into the air. Becquerel and Breschet employed Saussure's method in their experiments made on the top of the Great St. Bernard. Having spread out upon the ground a piece of gummed sarcenet about eight feet square, upon which they enrolled two hundred and fifty feet of silk cord interlaced with fine wire, they sent it up on the tail of an arrow. The motion of the arrow through the air would not produce of itself any electricity, unless the air were moist. To be certain, however, that no electricity produced by the mode of making the experiment should come in to vitiate the results, these observers first sent the arrow in a horizontal direction, without being able to effect the electroscope.

Another method, at first so striking but now so trite, of making experiments upon atmospherical electricity, is by flying the kite. Here, indeed, was philosophy in sport made science in earnest. Franklin first made this bold experiment, of enticing down the lightning upon the kite-string, familiar to the world on the 15th of June, 1752. Science, poetry, patriotism, will repeat the threadbare story of the strips of cedar united into a cross and covered with a silk handkerchief, of the key, of the silk ribbon by which he held the string, of his early anxiety and his first disappointment while the string was dry, and his final exultation when the rain wetted it, the hempen fibres began to fly apart, and he drew the first spark of lightning on his knuckles. Romas, for whom Martins has unaccountably claimed priority in the kite experiment attempted to repeat it on the 14th of May, 1753. The weather seemed propitious for the object, but he could get no spark. On the 17th of June he raised a kite with 780 feet of string 550 feet high in the air, and having taken the precaution to twist a fine wire into his kite string he succeeded in obtaining sparks three inches long and one quarter of an inch in thickness.

On the 16th of August, 1757, he performed the experiment with magnificent success, obtaining sparks of lightning one inch thick and ten feet in length. Charles, it is said, did most to give popularity and fame to the kite experiment.

Charles, who was fortunate in having Fresnel as his successor and Fourier as his eulogist in the French Academy, was born at at Baugency on the 12th of November, 1746. He was inspired to undertake physical investigations by the brilliancy of Franklin's career. To this end he left the public service, and lectured on science for thirty years, being honored sometimes by the presence of Franklin and Volta. Franklin complimented his experimental skill by confessing that Nature refused nothing to him, but obeyed him as her master. It is worth remembering, as being perhaps partly the secret of his success, that he studied the minutest points of his lectures with remarkable care; and often expended days in preparing an experiment in his laboratory which flashed off before the public in a few minutes. Among several who experimented with the kite, we may mention Cavallo, who discovered as Islington, in 1775, a large amount of electricity in the air when there was no thunder, and only here and there a solitary cloud. About 1800, Cuthbertson tried experiments on atmospherical electricity with a kite. He made the remarkable observation that the spark was very pungent when a long string was used, and from experiments with an electrical machine he came to the accurate conclusion, that the increased intensity was caused in some way (now better understood) by the length of the string as such, and not by the greater elevation of which a long string admitted. When a jar was slightly charged and the spark was only one tenth of an inch in length, it gave a smart shock if the charge was sent through a long string. For attaining unusual elevations, Cuthbertson conceived the idea of sending out one kite after another, in tandem style, sometimes to the number of three, each with five hundred feet of wire. The opposite currents, which are often encountered at different heights, make this experiment a very difficult one. Sturgeon, of Woolwich, England, made four hundred kite experiments, extending over a period of six years. He describes at length an experiment at Addiscombe in March, 1824. When he had half a mile of string out, he obtained a rapid series of sparks, through a plate of air one and a half inches thick. In the afternoon he attached the lower end of this string to the back of another kite, so as to let out one quarter of a mile more of string. Now the sparks became painful. At other times, even with three kites deployed in line, the electrical effects were insignificant. In hot and sultry weather, Sturgeon found the shocks violent when the kite had risen no higher than a church-steeple, and the string not even insulated. Sometimes they became so intolerable, that he could not pay out the string through the hand, and was obliged to use a reel. Electric disturbances were felt often when the kite was not within a quarter of a mile of any cloud. These were the effects of electrical induction. Sturgeon remarks that "Sergeant Rudd, of the Royal Artillery, if still alive, remembers well the effect of an electrical wave. Having presented his hand to the kite-string several times without experiencing even a spark, in the Artillery Barrack grounds at Woolwich, he began to laugh at the idea of electric shocks from the air. Shortly, however, I espied a cloud making its appearance behind the Repository, and on its approach asked the Sergeant to try again. He did so, but before he got his hand near to the string, a discharge struck it and sent the sceptic reeling, to the great amusement of his brother non-commissioned officers who were present." On the 29th of March, 1842, Sturgeon floated his kite with three hundred yards of wired cord just before the approach of a hail-storm, when he obtained a rapid succession of sparks through an interval of air six inches in length, or a constant stream of fire through a length of three inches. It was no unusual sight for the string and reel to bristle with purple light, and the blades of grass for yards around to be tipped with fire. Once Sturgeon lost a kite by the melting of the wire nine hundred feet from the ground. A cloud was visible, but no thunder was heard. In 1834 a man received a severe shock from a kite-string which he touched with a stick four feet long. This occurred during a hail-storm. On one occasion, Sturgeon received a shock through three feet of dry ribbon, attached as a handle to the kite-string, when no visible cloud was within a mile. The end of the string was tied to a tree, and it was not possible to take down the kite until a cloud far to the windward had passed over to the leeward. And generally, the presence of a cloud makes a decided effect on the electrical activity of the atmosphere. Franklin and Saussure were under the persuasion that lightning never issued from a lone cloud. But Arago has adduced five cases in which destruction to trees and animals has come forth from this source. As such a cloud approaches the kite, the electrical sparks drawn from the string increase in length and intensity.

Weekes has objected to the kite experiment as a proper means of studying atmospherical electricity, because it is calculated to give only local phenomena. He thinks that the more general features of the case would be better obtained by horizontal wires of great length, and presenting a large amount of surface to the influence of the air. About 1841, Weekes erected a wire for this purpose at Sandwich, on the south-east coast of England. This wire was stretched over the town, a distance of 1095 feet, and one end was attached to the vane-spindle on the tower of St. Peter, and the other to the vane-spindle on the tower of St. Clement. The elevation of the wire at the two extremities was one hundred and thirty-six feet above a base line running between the two edifices. Its average elevation above the sea was fifty-five feet. A vertical wire was attached to the middle of this horizontal wire, and descended into the room of the observer. Provision was made to carry the charge, in whole or in part, to a distant well, whenever it became dangerous in magnitude or suited the purpose of the observer to do so. Weekes observes, that, "even the light and feathery aggregations of the summer cloud are sufficient to effect the electroscope, through their inductive action on the outstretched wire. And when thunder-clouds were forming, the action was so potent that liquids were chemically decomposed, metals were deflagrated, and large quantities of coated surface were charged and discharged in a few seconds. Some inconvenience arose from the weight of birds, particularly of swallows, which settled on the wire. Sometimes they occupied the whole length of wire in a protracted session, debating as it might seem in relation to their autumnal departure for fairer climes. Weekes remarked, that on the 16th of September, 1840, during a sudden rain, there were witnessed furious discharges of sparks from ball to ball of his apparatus, though there was but little thunder, and an interval of five or six seconds between the flash and the report showed that that little was a mile distant. Weekes after a time found it necessary to confine the horizontal wire near the middle, to protect it from the violence of the winds. Before he did so, it gave out music, as the telegraph-wires are known to do, like a vast Æolian string. His neighbors regarded these sounds with superstitious awe, and predicted that no good would come of them. No good did come to Weekes; for they persecuted him in all the little ways which are still possible in an age of freedom and intelligence.

The apparatus and experiments of Weekes have served to attract attention to observations which Crosse had been making

on the same subject at Broomfield for thirty years. Crosse's atmospheric apparatus consists of wire, one third of a mile in length, insulated upon poles or upon the tops of trees in his park. By the slight motion of a lever, the electricity from the air is introduced into his study or dismissed into a safety channel which is connected with the ground. Crosse's wire is higher above the level of the sea than Weekes's apparatus, but it does not stand so high above the ground underneath, and hence it did not manifest so energetic symptoms of electricity. But even this sufficed to charge and discharge a Leyden battery with seventy-three feet of coated surface, twenty times in a minute, and with a report as loud as that of a cannon. Strangers ran away, and an exaggerated report was spread, that the neighborhood was filled all the time with thunder and lightning. This alarm had the advantage of protecting the fruit-trees of Crosse from the depredations of vagrants. Crosse is a retired country gentleman, and has spent fifteen thousand dollars on his apparatus, although he is his own mechanic. In spite of his own modesty he has obtained celebrity from those experiments, on which the author of the "Vestiges of Creation" has laid stress. Sir Richard Philips has given some account of a visit which he paid to Crosse's scientific establishment. He found there his voltaic magazine, consisting of 2500 pairs of voltaic elements, 2,000 of which were in operation at one time.

The immense length of telegraph-wire standing in this country and elsewhere has entirely eclipsed the apparatus of Weekes and Crosse, though not originally intended, nor often used, for studying atmospherical electricity. Even when the wire is not struck, it is electrified by induction, and the lightning begins to make the record on its own account. Sometimes this induced action is felt at the distance of twenty miles. A storm at Baltimore has set the magnets in motion at Washington. Professor Henry has recorded a case, where the writing part of the telegraph began to work at one end of the line, from the influence of a snow-storm at the other end. The presence of induced electricity on these wires will also betray itself by a spark wherever there is a break.

I have finished the general description which I intended to furnish of the various appliances to which observers have resorted, in testing the presence and character of atmospherical electricity. And I am now ready to give some of the results of their investigations: such, at least, as have not been already anticipated. The first and most fundamental of these results was the discovery of the reality of atmospherical electricity; the determination, that is, of the identity between lightning and electricity. This identity, speculatively dreamed by Gilbert and revived in the minds of Hawksbee, Wall, Winkler, Gray, Nollet, was apprehended by Franklin with a clearness and force of conviction which did not let him rest until he had settled the question experimentally. The proof of this identity consisted in drawing down the lightning from the skies in moderate quantities, and performing with it the common experiments of electricity. As the science of electricity has acquired a wider range by the discovery of voltaic electricity and electro-magnetism, an opportunity has been afforded for placing the identity of atmospheric and common electricity upon a broader basis. While, therefore, Franklin and his contemporaries charged the Leyden jar with lightning, and showed the shock, the spark, the heat, of electricity, Sturgeon, Colladon, and Peltier have used it to magnetize steel needles and to deflect the galvanometer.

Other results which have been experimentally obtained are in answer to such questions as these:—Is the electricity of the atmosphere and of the clouds positive or negative? How is it distributed? What relation does it bear to times and seasons? How is it produced? What are its effects?

With regard to the character of the electricity, it may be said that the earth is generally charged negatively, and the atmosphere positively; the intensity of the positive charge increasing with the elevation of the stratum observed. Any discrepances between observers in respect to this point may be referred to local action. Peltier has proved the negative character of the solid earth as compared with its atmosphere by means of the galvanometer. One end of the multiplier was joined to a pointed rod of metal and raised into the air, the other end being soldered to a metallic plate which was buried in the earth. As the electricity under examination possesses considerable tension, the the strands of the multiplier must be insulated from each other with unusual care. Sturgeon found the electricity of the air most positive during the cold northeast winds of March. Weekes observed that the electricity was strong when there was a breeze from the eastward. Cuthbertson states that he always found the electricity of the air positive. Crosse, on the other hand, thought the air was always negative. Davy, too, in his Agricultural Chemistry, seems to imply that the air is negative. In some of the observations, probably, the requisite precautions were not taken to guard against deception. Pine cautions the observer against making his experiment near a tree. The free electricity of the air, positive in character and increasing with the elevation of the spot observed, is not found in the interior of buildings. The air of rooms vitiated by respiration is negative according to Murray. He also states that the air at Orbitello and in the Pontine Marshes is negative. The most intense charge is observed in open places, such as quays, bridges, and squares. In such localities as Geneva, where low fogs prevail, it is particularly intense. A persistent series of systematic observations in electrical meteorology may perhaps bring these discordant and anomalous results of observation into harmony with each other. It is no small part of the difficulty, that the instruments which report of the electrical state of the air may, like those which measure its temperature, or its moisture, or its winds, respond more promptly to local than to general influences, and so give an uncertain sound, instead of registering that state, as the barometer registers the physical element to which it is adapted, in its most general character. A series of daily observations made by Schubler, at Stuttgard, from May, 1811, to June, 1812, in all kinds of weather, may throw some light upon the subject. He reached the following results:—1. The charge of electricity is more intense in storms of rain, or hail, or snow, than when the sky is fair. 2. At such times the charge is as often negative as positive. 3. The character in this respect often changes suddenly. 4. In cloudy weather, without any storm, the charge is positive. 5. The intensity of the charge is greater in winter than in summer. Schubler also studied the electrical phases of the atmosphere at different periods of the day, and discovered some correspondence between the diurnal variation of the magnet and the daily curve of electrical intensity. The minima of intensity occurred before sunrise and again two or three hours after noon, and the maxima two or three hours after sunrise and after sunset. The range of the daily change increased from July to January, and decreased from January to July. In 1830, Arago repeated at Paris the same series of observations on the daily curve, and with similar results.

As a body becomes positively charged only at the expense of another which loses electricity and is therefore negatively charged, the electricity of the air and of the clouds, whether in fact positive or negative, implies the existence of an opposite charge in the earth itself. The solid earth, *with* its atmosphere, has the

same average fund of electricity always. There is no proof that it ever borrows electricity of foreign orbs or makes to them a loan of its own. The phenomena under consideration are purely meteorological, and not cosmical. It is by a change in the distribution of this normal quantity of electricity that one part of the planet acquires an excess while another is deficient. But it is not so easy to prove by direct experiment that the earth is negatively charged, as to draw down and handle the positive electricity of the clouds. The unequal amount of evaporation in different parts of the earth's surface, and a partial distribution of moist winds, will produce charges of electricity in the air much larger at some places than at others, and the imperfect conducting power of the air will be unfavourable to a speedy equalization. On this account the electricity of the air will be in a large sense of a local character. The opposite and corresponding charge of the solid earth will more easily spread over its whole surface. With the ample range thus afforded to its own inherent diffusiveness, it will retain only a feeble power at any one place. It is not surprising, therefore, that the electrical charge of the solid earth is rarely recognized by the senses. Sometimes, and in some places, geographical locality may be opposed to an immediate diffusion of the electricity, so that if the exciting cause is active, a sufficient charge may accumulate to attract attention. In such cases, the electricity, following so far as it can spread the usual laws of distribution, will concentrate its forces around the sharp peaks of mountain-tops, which are the natural and appointed dischargers to the planet. Hence positive clouds are seen to congregate as if by electrical attraction around the pinnacled battery of the earth. The electricity of the earth shows itself, if at all, by a brush or star of light on pointed objects resting on the earth, and projecting into the air. The records of these displays have accumulated with years, and are found in the literature and common language of every age and country. The ancients distinguished them by the name of Castor and Pollux. In modern times, and around the shores of the Mediterranean, they are hailed as the light of St. Clare, St. Nicolas, St. Helena, and elsewhere they bear the appellation of St. Barbe or St. Elmo. The Portuguese call them Corpo Santo, and the English, Comazants. These lambent flames, as they appear, have been seen blazing from the summits of the Himalaya and Cordillera mountains. They are frequently seen tipping with fire the masts and spars of ships. We are told that in the voyage of Columbus, as soon as St. Elmo appeared with his wax tapers, the sailors began to sing, thinking that the storm was over. The electricity of the earth while in the act of discharging itself into the air has been seen edging with light the manes of horses, the metal trimmings of their harness, the lashes ot whips, the brims of hats, the tops and edges of umbrellas, the sharp points of swords and lances, the extremities of hair and whiskers, the corners of chapeaux, the buttons upon the coat, filaments of straw, the beaks of birds, and the myriad needle-like terminations of vegetable growth, with that incomparable point and finish which they took from Nature's own hands. In 1778 these electrical brushes embellished the crosses upon the steeples in Rouen, as well as other points of eminence. At the siege of Kingsall, in 1601, the sentinel saw electrical tapers burning on the points of lances and swords. Guyan says, that they are often noticed on the bayonets of the soldiers at Fort Gowraya, Bougie, 2200 feet above the level of the sea. During a thunder-storm they have appeared like the work of induction, gleaming upon the points of the fire-arms in the armory of the Tower of London. In Poland, Captain Bourdet was astonished to see, in December, 1806, the electrical glow upon the ears of the horses, on the metallic knobs of their harness, and on the whiskers of the troops. On the 25th of January, 1822, the tops of the trees at Freyburg were touched with light during a snow-storm. In 1824, a load of straw became animated and danced the electrical hop, each straw standing on end, and shining at the top. In 1825, Sir William Hooker and a party of botanists who were upon Ben Nevis, shed the electrical light from their hair when they lifted their hats. In May, 1831, the hair of the officers at Algiers stood erect, decked out with fire. Walker, the English electrician, on the 8th of September, 1842, saw the same light on the top of his own lightning-rod. On the 17th of January, 1817, an extensive snow-storm was experienced in Maine, Vermont, Massachusetts, and even in Pennsylvania and Georgia. Professor Cleaveland says, that upon this occasion three persons, crossing the bridge over the Androscoggin, observed the borders of their hats to be luminous, and the ends of their fingers, though covered with gloves, were radiant with light. Professor Dewey of Williamstown relates, that upon the same occasion a physician saw the light upon the ears and hair of his horse. A gentleman tried to brush it from his hat, thus reminding one of the sailor who was sent to the top-mast to bring the fire of St. Elmo down. In both cases the experiment was attended with the same success. The light spread more widely for being disturbed. Other persons witnessed the same brightness on the trees, fences, and logs. It was reported that a hiss was heard when the hand was presented to these objects. Moreover, the lightning was frequent. A young man in Vermont described the phenomenon after this wise. It appeared as a star or spark oftener than as a brush. A sound could be heard at the distance of six or eight feet resembling that of water in a tea-kettle just before it boils. The effect was greater on high ground than on low, so that the light was then seen on the hat and shoulders. The brush was sometimes two inches in length, and three quarters of an inch in diameter. To spit was to emit from the mouth a luminous stream of fire. At Shelburn, Massachusetts, a similar light was seen upon a well-pole: when the end came down the light disappeared, and was kindled again when it went up. Arago mentions other cases where the spit was luminous, and one at least has come within my personal observation at Cambridge. In 1767, Tupper and Lanfiar observed near Mount Etna, that by moving their hands through the snowy air they produced sounds which could be heard at the distance of forty feet. In 1781, Saussure, the great Alpine observer, felt a cobweb sensation among his fingers, and his attendants were able to draw sparks from a gold button on his chapeau. The beaks of birds have appeared luminous during storms, and it has been suggested that the eagle by some preeminence in this respect acquired its cognomen of the minister of the thunder-bolt. We may introduce here an experience of Sabine and James C. Ross, during an arctic voyage, as indicating possibly the electrical condition of the earth or air. They entered a luminous track, about four hundred metres long, and while in it they could see the tops of their masts, the sails and cordage of their ship, and when they left it they passed suddenly into outer darkness.

Arago has collected, with amazing industry, passages from the classics which may possibly contain allusions to the electrical light. Thus Cæsar, in the African War, says that the lances of the fifth legion seemed on fire during a night of hail-storms. Livy states, that the javelin of Lucius Atreus cast forth flames for two hours without being consumed. Plutarch records the fact, that when the fleet of Lysander was on the point of attacking the Athenians, Castor and Pollux arose and stood on the two sides of the galley of the Lacedemonian admiral. He refers to similar observations in Sardinia and Sicily. Pliny had seen just such lights on the points of the soldiers' pikes. Seneca alludes to a star which reposed on the iron part of the lance of Gylippus,

near Syracuse. And then there was the fire around the head of Ascanius.

(*To be continued.*)

Francois Arago.*

Death has recently made grievous inroads into the ranks of French science. We have seen the fall, successively, of Laurent, Auguste de St. Hilaire, the Botanist, Adrien de Jussieu, the last male descendant of the brilliant dynasty of the Jussieus, who died in July last, President of the Academy of Sciences, and member of the Botanical Section. A loss, still more recent, has increased this list of the dead—a loss irreparable, for it is that of a man, who was at the same time an illustrious philosopher, a champion of popular progress, and a distinguished citizen.

Francois Arago was born on the 26th of February, 1786, at Estagel, a small village of 3000 inhabitants, situated near Perpignan (Eastern Pyrenees). His father was Treasurer of Perpignan. With a moderate patrimony, and a numerous family, he could not give his children a liberal education; but Madam Arago was able to supply it, and devoted herself to their instruction; and she afterwards had the richest recompense which a mother can look for: her sons were all men of distinction. Besides Francois, who immortalized himself by his discoveries, we see Jacques and Etienne, who are distinguished in literature; Jean and Joseph, who were brave officers in the Mexican service; and last, Victor Arago, the youngest, now commandant of the Artillery.

The appearance of Francois Arago on the arena of Science was most opportune. His father had destined him to the law; but the young man had other tastes. He met one day an officer of engineering drawing a plan on the ramparts of the city, and enquired of him how he could obtain the right of wearing so fine a uniform. "Become a scholar of the Ecole Polytechnique," was the reply. From that time the career of the young man was determined. Having no instructors, he gave himself to books, and in 1803, at the age of 17 years, he entered this National School.

At the end of a year he had left behind him all his fellow students, and was attached by Monge to the Observatory of Paris, where he commenced his researches in Physics and Astronomy.

In 1806, he left for Spain, where he continued under the direction of M. Biot, the measure of the meridian of France, which had been interrupted by the death of Mecham. On the demand of the National Convention which established the Decimal system, Delambre and Mecham undertook the measurement of an arc of the meridian between Dunkerque and Barcelona. It was this measurement that MM. Biot and Arago continued to the Balearic Islands. This journey in Spain was full of dramatic incidents to Arago. Encamped on the summits of the elevated peaks of Catalonia, our observer had to contend in turn with the wind, the cold, and hunger, and also with brigands, the chief of whom ended by becoming the Protector of our young savants.

A year after their departure for Spain, MM. Biot and Arago had nearly completed the measurements as regards Spain. The former then returned to Paris, and Arago went on to Majorca to continue his operations. But the war was on the point of breaking out between France and Spain; and the night signals, the instruments, and the movements of the young Frenchmen who remained at work about the summit of Galatzo, rendered him an object of suspicion to the Majorcans, and Arago was arrested and thrown into the citadel of Belver. He managed to escape, and embarked with his papers and instruments for Algiers. The French Consul made him reembark for Marseilles, but at the moment of entering the Gulf of Lyons, the vessel was captured by a Spanish corsair and conducted to Rosas; Arago and his companions were at first imprisoned and then thrown into the Pontoons of Palamos. At last, through the reclamation of the Dey of Algiers, to whom the vessel belonged, Arago and his associates were returned to Algiers. But a revolution had there taken place, and the Dey had just been decapitated; the new Dey was unwilling to let Arago go away, whom he supposed to be possessed of treasures, and under the direction of the Danish Consul, Arago was consequently thrown into slavery. Finally, after a series of vicissitudes of various kinds, he succeeded again in quitting Algiers, and on the 2nd of July, 1809, he entered the Lazaretto of Marseilles, with all his instruments which he had succeeded in preserving.

France had believed him dead. The first letter which arrived for him at the Lazaretto was one from Humboldt; who knew him only from his misfortunes, and from that time a friendship commenced between these two great men which continued to the end. On the 17th of the September following, Arago entered the Institute: he was then 23 years old. Already he had made with Biot an extensive work on the determination of the coefficient for tables of Astronomical refraction; he had measured the refraction of different gases, a research that before had not been attempted; he had determined the relation between the weight of air and that of mercury, and found a specific value for the coefficient in the formula for calculating the heights of mountains from barometric observations; he had also made an important investigation on the velocity of light, and numerous observations towards the verification of the laws of libration; and finally he completed the triangulation prolonging the meridian of France to the island of Formentosa.

In 1812, the Bureau des Longitudes charged him with the delivery of a course of lectures on Astronomy at the Observatory, which was continued until 1847, presenting in them the most arduous details of the science. On the 7th of June, 1830, he was named perpetual Secretary of the Academy of Sciences, replacing Fourier. From this moment a new life actuated the Academy, and it was under the impulse received from Arago that this illustrious society attained in a great degree to that distinguished standing and authority now accorded to it by the scientific world.

The revolution of 1830 broke out, and Arago entered political life. Named a member of the Chamber of Deputies, he took his seat among the republicans; and being a great orator, he was not slow to acquire influence in the parliamentary debates. It was on his Report, that a national recompense was voted to Daguerre, the inventor of Photography, and to Vicat, the inventor of hydraulic cements. He voted the printing of the works of La Place and those of Fermat; he defended the railroads against the coalition of the "maitres de porte;" he protected electric telegraphs against the adverse intentions of the administration represented in the Chamber of Deputies by M. Pouillet, the physicist; in a word, in all circumstances, Arago was at the head of Progress.

The revolution of 1848 brought Arago into the Provisional Government. He had just completed his eulogy of Bailey, the Astronomer, the friend of Franklin, who took an active part in the revolution of 1789, of which he was a victim. Reasoning by analogy, Arago looked for a like fate. This fear was happily exaggerated. Times had changed as well as circumstances, and the only analogy between the two men, Bailey and Arago is that both were astronomers and both perpetual Secretaries of the Academy of Sciences.

* Correspondence of M. Jerome Nickles. Silliman's Journal.

After the coup d'etat of December 2, 1851, Arago refused to take the oath of allegiance, which was required of him in his capacity of director of the Observatory, and thus made manifest once more that politics ought to be kept aloof from Science.

A life of so much labour had worn down his health. Although attacked with diabetes, he still contemplated putting the last touch to his unfinished works. Bright's malady set in and aggravated his situation, which was complicated with dropsy of the abdomen, attended with effusions, and swelling of the extremities. All announced his approaching end: yet his mind was not for a moment obscured. Shortly before his death, although blind, he superintended in some difficult researches; he asked M. Babinet to prepare for him a table of more accurately determined numbers for the lengths of undulations, that he might bring to completion a memoir of interferences; and he finished the editing of his Physical researches on the Planets, &c. &c. He died in the midst of these arduous occupations, on the 2nd of October, at the age of 67½ years, a few minutes after having shaken the hand of M. Biot.

We have mentioned some of the works which Arago accomplished in his younger days. These works were completely eclipsed by the discoveries to which his name has since become attached, which embrace the following principles:—

1. The discovery of chromatic and rotary polarization.

2. That of Electro-magnets.

3. That of the magnetism which is developed when bodies are revolved near a magnet.

Arago was an Encyclopædic genius. Science, Literature, Political and Social economy, his vast intelligence embraced all with equal ability. His powerful faculty of assimilation, popularization, and of application of principles, placed him everywhere in the first rank. Whether Orator or Professor, he shone with brilliancy both in political and scientific assemblages. He was distinguished for the perspicuity and elegance of his style, and occupies an eminent place among the prose writers of France.

In the midst of so much grandeur, Arago led a most modest life. He considered as lazy whoever did not work fourteen hours a day; and such days were for him days of repose. Although so absorbed with his occupations, he still found time to appear in the society of Paris as one of its most spirited conversationists.

While devoted to continued labor, he completely forgot his own interests, and had only what was barely necessary for the support of his family. He left two children, one Emanuel Arago, an eloquent orator of the bar of Paris and of Republican assemblies, the other Alfred Arago, a distinguished painter. If he has not bequeathed to them a fortune, he has left an immortal name: he has created by his genius a renown more illustrious than all the renown ever gained by arms—which for a long time enjoyed the privilege of giving fame, but now yields the right to the peaceful conquests of science.

Geology of Gold.

The geology of gold may now be considered as tolerably well understood. *In situ*, it is found in the primitive rocks, granite, gneiss, mica slate, clay-slate, and porphyry; and having been freed from its original bed by the decomposition and disintegration of the rocks, and washed out by the rains, it is found in the beds of mountain streams and rivers, and in many alluvial soils in flat countries, through which mountain torrents occasionally flow. It is most frequently associated with quartz and oxides of iron, and with iron pyrites, sometimes with felspar, hornstone, calcareous spar, barytes, red silver ore, silver glance, sulphuret of copper, peacock copper ore, malachite, the various ores of lead, sulphuret of zinc, grey ore of antimony, cobalt, manganese, copper nickel. arsenical pyrites, orpiment; and this information will enable parties in possession of mineral lands to form a judgment whether specimens from them are worthy of a trial for the production of the precious metal. In addition to Australia, and the developement of gold in Great Britain and Ireland, it is the opinion of Mr. Calvert, and many explorers in Canada, that the gold deposits discovered in the valley, and in the sands of the Chaudiere River, will lead to the developement of other highly important results in that colony, and we would here remark, that although Mr. Calvert's exertions are not duly appreciated in some quarters as they deserve, he undoubtedly is entitled to all credit as the principal pioneer in the present movement.

Central Africa.

Dr. Vogel in a letter addressed to Colonel Sabine dated Mourzuk, October 14th, 1853, says:—

"There is no regular rainy season at Mourzuk; but slight showers occur sometimes in the winter and spring; seldom in the autumn. Heavy rain is considered as a great calamity, as it destroys all the houses, which are built of mud dried in the sun. It also kills the date-trees, by dissolving the salt which exists in large quantities in the soil. About 12 years ago about 12,000 date-trees perished in the neighbourhood of Mourzuk, on account of rain which continued for seven days. The prevailing winds are south and east; the strongest generally west or north-west. I have seen whirlwinds two or three times pass through the town,—a phenomenon which was common in the desert between Bencolua and Mourzuk: all the whirlwinds which I observed turned from the east to north, and went to south

"In December and during the first half of January, the thermometer falls at sunrise, at Mourzuk, as low as 42°, and in places exposed to the wind water freezes during the night. At Sakna, I could not find any one who could remember having seen snow. At Tripoli we had heavy dews at night, and I observed the same until we had passed a small chain of mountains fifteen miles north of Sakna. Thence we had no dew, and it was often impossible to obtain the dew point with Daniell's hygrometer. In the desert the thermometer generally rose till 4 P. M., from the sand (which was sometimes heated to 140°,) giving out its heat. Earthquakes are sometimes felt. Great numbers of shooting stars were observed on the 7th, 8th, and 31st of July; very few on the evenings of the 9th, 10th, and 11th of August; but they were again very numerous on the 1st, 2nd, and 3rd of October."

On the Food of Man.*

BY DR. LYON PLAYFAIR, C. B., F. R. S.

The author commenced by adverting to our very imperfect acquaintance with the statistics of Food. We are still ignorant regarding the quantity of the different proximate constituents of aliment necessary for man's sustenance, even in his healthy and normal condition. If the question were asked—How much carbon should an adult man consume daily?—there would be scarcely more than one reliable answer, viz., that the soldiers of the body-guard of the Duke of Darmstadt eat about 11 oz.† of carbon in the daily supply of food.

*This is an Abstract of a Lecture given at the Weekly Evening Meeting at the Royal Institution, Friday, May 6, 1853.

†Liebig states it at a higher amount, but this is a re-calculation from the new food table.

If again the question were asked—How much flesh-forming matter supports an adult man in a normal condition?—no positive answer could be given. Even, as respects the relation between the carbon in the flesh-forming matter and that of the heat-givers, we have no reliable information. It is true that certain theoretical conclusions on this head have been drawn from the composition of flour, but no real statistical answer deduced from actual experience exists.

When we inquire into the cause of our ignorance on these points, it is found that the progress to knowledge is surrounded with difficulties. Neither chemistry nor physiology is in a sufficiently advanced state to grapple satisfactorily with the subject of nutrition. For example, we know that albumen in an egg is the starting-point for a whole series of tissues; that out of the egg come feathers, claws, fibrine, membranes, cells, blood corpuscles, nerves, &c., but only the result is known to us; the intermediate changes and their causes are quite unknown. After all, this is but a rude and unsatisfactory knowledge. Hence, when we approach the subject it is only to deal with very rough generalities. Admitting that the experience of man in diet is worth something, it is possible to arrive at some conclusions by the *statistical* method—that is, by accepting experience in diet and analyzing that experience. Take, for example, the one general line of Pauper Diet for the English counties placed in the table at the end of this notice. The mode of arriving at the result of experience, in the case of paupers, was to collect it from *every* workhouse in the kingdom, and then to reduce it to one line. But the labour of this is immense. In the preparation of this one line the following work had to be performed in acquiring the data:

Number of Unions applied to	542
Number of Explanatory letters sent to them	700
Number of Calculations to reduce the results	47,696
Number of Additions of the above calculations	6,868
Number of Extra hours, *beyond the office hours*, paid to a Clerk for the reduction	1,248

The statistical method, besides being very laborious, is extremely tedious, and has thus deterred persons from encountering it. In giving, therefore, an example of some of the results which have been collected within the last few years, they will represent much labour, but very little or no originality.

The lecturer then alluded shortly to the conditions in nutrition, which must be borne in mind in looking at these results. It was now admitted that the heat of the body was due to the combustion of the unazotised ingredients of food. Man inspires annually about 7 cwt. of oxygen, and about one-fifth of this burns some constituent and produces heat. The whole carbon in the blood would thus be burned away in about three days, unless new fuel were introduced as food. The amount of food necessary depends upon the number of respirations, the rapidity of the pulsations, and the relative capacity of the lungs. Cold increases the number of respirations and heat diminishes them; and the lecturer cited well known cases of the voracity of residents in Arctic Regions, although he admitted, as an anomaly, that the inhabitants of tropical climates often show a predilection for fatty or carbonaceous bodies. He then drew attention to the extraordinary records of Arctic dietaries shown in the table, which, admitting that they are extreme cases, even in the Arctic Regions, are nevertheless very surprising.

Dr. Playfair then alluded to the second great class of food ingredients, viz., those of the same composition as flesh. Beccaria, in 1742, pointed to the close resemblance between these ingredients of flesh, and asked "Is it not true that we are composed of the same substances which serve as our nourishment?" In fact the simplicity of this view is now generally acknowledged; and albumen, gluten, casein, &c., are now recognized as flesh-formers in the same sense that any animal aliment is. After alluding to the mineral ingredients, attention was directed to a diet-table, which contained some modifications, but was based on the one published in the *Agricultural Cyclopædia* under the article *Diet;* the table as shown being used in the calculation of the dietaries.

The old mode of estimating the value of dietaries, by merely giving the total number of ounces of solid food used daily or weekly, and quite irrespective of its composition, was shown to be quite erroneous; and an instance was given of an agricultural labourer in Gloucestershire, who in the year of the potato famine subsisted chiefly on flour, consuming 163 ounces weekly, which contained 26 ounces of flesh-formers. When potatoes cheapened, he returned to a potato-diet, and now eat 321 ounces weekly, although his true nutriment in flesh-formers was only about eight or ten ounces. He showed this further, by calling attention to the six pauper dietaries formerly recommended, to the difference between the salt and fresh meat dietary of the sailor, &c., all of which, relying on absolute weight alone, had in reality no relation in equivalent nutritive value.

Attention was now directed to the diagrams exemplifying dietaries. Taking the soldier and sailor as illustrating healthy adult men, they consumed weekly about 35 ounces of flesh-formers, 70 to 74 ounces of carbon, the relation of the carbon in the flesh-formers to that of the heat-givers being 1 : 3. If the dietaries of the aged were contrasted with this, it would be found that they consumed less flesh-formers (25—30 ounces,) but rather more heat-givers (72—78 ounces;) the relation of carbon in the former to that of the latter being about 1 : 5. The young boy, about ten or twelve years of age, consumed about 17 ounces weekly, or about half the flesh-formers of the adult man; the carbon being about 58 ounces weekly, and the relation of the two carbons being nearly 1 : 5½. The circumstances under which persons are placed influence these proportions considerably. In workhouses and prisons the warmth renders less necessary a large amount of food-fuel to the body; while the relative amount of labour determines the greater or less amount of flesh-formers. Accordingly it is observed that the latter are increased to the prisoners exposed to hard labour, From the quantity of flesh-formers in the food, we may estimate approximately the rate of change in the body. Now a man weighing 140 lbs. has about 4 lbs. of flesh in blood, 27½ lbs. in his muscular substance, &c., and about 5 lbs. of nitrogenous matter in the bones. These 37 lbs. would be received in food in about eighteen weeks; or, in other words, that period might represent the time required for the change of the tissues, if all changed with equal rapidity, which is, however, not at all probable.

All the carbon taken as food is not burned in the body, part of it being excreted with the waste matter. Supposing the respirations to be 18 per minute, a man expires about 8.59 oz. of carbon daily, the remainder of the carbon appearing in the excreted matter.

In conclusion, Dr. Playfair explained how the dietary-tables elucidated the various admixtures of food common to cookery, and how they might even be made to bear on certain national characteristics, which were in no small degree influenced by the aliments of different nations.

EXAMPLES OF DIETARIES AS SHOWN IN THE DIAGRAMS.

REMARKS	Weight in Ounces per Week.	Nitrogenous Ingredients.	Substances free from Nitrogen.	Mineral Matter.	Carbon.	Proportion between Carbon in Flesh-Formers.	Carbon in Heat-Givers.
Dietaries of Soldiers and Sailors.							
English Soldier	378	36.15	127.18	4.92	71.68	1	3.66a
Ditto in India	261	34.15	103.19	2,39	66.32	1	3.58a
English Sailor (Fresh Meat)	302	34.82	102.89	3.17	70.55	1	3.70a
Ditto (Salt Meat)	290	40.83	132.20	6.03	87.40	1	3.94a
Dutch Soldier, in War	198	35.21	102.08	1.85	74.08	1	3.87b
Ditto in Peace	383	24.52	106.80	4.15	70.77	1	5.32b
French Soldier	347	33,24	127.76	4.62	85.25	1	4.72c
Bavarian ditto	242	21.08	102.10	3.32	62.45	1	5.47c
Hessian ditto	423	23.0	136.0	...	77.0	1	6.16d
Dietaries of the Young.							
Christ's Hospital, Hertford	216	17.16	61.27	2.47	39,18	1	4.21e
Ditto ... London	242	17.27	76.82	2.84	46.95	1	5.02e
Chelsea Hospital, Boys School	245	12.89	93.28	5.93	57.67	1	8.29e
Greenwich Hospital, ditto	231	18.43	86.73	2.62	52.87	1	5.29e
Dietaries of the Aged.							
Greenwich Pensioners	269	24.46	122.21	3.54	72.43	1	5.46f
Chelsea ditto	332	29.95	112.64	4.65	78.03	1	4.80f
Gillespie Hospital, Edinburgh	156	21.02	92.32	2.35	71.39	1	6.26f
Trinity Hospital, ditto	192	19.63	97.34	3.33	57.30	1	5.38f
Old Pauper Dietaries.							
Class 1.	...	20.21	88.61	3.27	54.30	1	4.95g
" 2.	...	14.96	89.59	2.89	51.10	1	6.31g
„ 3.	...	15.78	99.88	3.91	55.43	1	6.50g
„ 4.	...	19.22	116.84	3.96	67.87	1	6.50g
„ 5.	...	15.49	96.51	3,58	54.72	1	6.53g
„ 6.	...	14.67	88.03	2.84	49.57	1	6.25g
Average of all English Counties in 1851	...	22.0	99.0	...	58.0	1	4.85h
St. Cuthbert's Edinburgh	175	14.80	89.37	3.31	46.98	1	5.85 i
City Workhouse, ditto	107	13.30	49.99	1.74	31.48	1	4.36 i
English Prison Dietaries.							
Class 2. Males	206½	15.28	111.85	3.46	59.23	1	7.13j
„ 3. ditto	276	18.26	123.60	4.05	67.53	1	6.81k
„ 4, 8 and 9. ditto	229	20.97	159,98	5.03	69.88	1	6.13l
„ 5. ditto	326	20.29	130,57	4.23	73.31	1	6.65m
„ 6. and 7. ditto	271½	20.97	125.98	5.03	69.88	1	6.13n
Bengal Prison Dietaries.							
Non-Labouring Convicts	224	18.43	163.16	2.08	76.35	1	7.62o
Working Convicts	296	28.16	191.12	2.97	91.07	1	5,96o
Contractor's insufficient Diet	167½	12.70	135,95	1.30	61.33	1	8.88o
Bombay Prison Dietaries.							
All Classes of Prisoners not on Hard Labour	182	28.00	101.50	2.03	68.81	1	4.52o
Hard Labour	224	35,63	128.80	2.45	87.22	1	4.50o
Arctic and other Dietaries.							
Esquimaux	...	250.0	1280.0	...	1125.0p	—	—
Yacut	...	999.0	640.0	...	966.0p	—	—
Bosjesmen	...	574.0	368.0	...	555.0p	—	—
Hottentot	...	424.0	400.0	...	604.0p	—	—
Agricultural Labourer, England	163.6	26.64	106.57	1.10	74.70q	—	—
Ditto ... ditto	114.6	20.39	72.46	1.18	51.72q	—	—
Ditto ... India	218.0	14.02	138.27	2.41	61.54r	—	—

a Public Dietaries. *b* Mulder. *c* Special return obtained.
d Liebig. *e* Special Returns obtained. *f* Special returns obtained.
g The Six Dietaries recommended as equivalent by the Poor Law Commissioners.
h Specially reduced from all the Unions of 1851. *i* Special returns.
j Convicted Prisoners exceeding 7 days, but not exceeding 21 days.
k Convicted Prisoners, Hard Labour, exceeding 21 days but not more than 6 weeks.
l Convicted Prisoners, Hard Labour, above 6 weeks and not more than 4 months
m Convicted Prisoners, Hard Labour, for terms exceeding 4 months.
n Solitary Confinement.
o From information supplied from the India House.
p These probably represent Extreme cases, mentioned by the following authorities:—Ross, 1835, p. 448. Parry, 1823, p. 413. Cochrane, p. 255. Saritcheff. Barrow, pp. 152, 258. Richardson, *vide* Agric. Cyc. article *Diet.*
q Gloucestershire and Dorsetshire. See Agric. Cyclopædia.
r Dharwar, Bombay—Return in Bombay Prison Dietaries.

On Cider and Perry Making.

Communicated by T. W. Booker, Esq., M. P. to the Journal of the Society of Arts.

At the recent Agricultural Meeting at Ledbury I made a few remarks on the production of Cider and Perry, which induced some of my constituents, there assembled, to seek a conversation with me afterwards on the subject, during which they requested me to "write another letter," with reference to the proper season for gathering the fruit and the mode of managing the fermentation of the liquor. If the remarks which I have to make shall awaken due attention on the part of the cider and perry producers of our country, I feel convinced of this, that, to use the words of one who wrote on the subject two hundred years ago, Dr. John Beale, a Fellow of the Royal Society, "these parts of England will be some hundreds of thousands of pounds sterling the better for it."

That the whole subject may be before us, I will beg you to copy the following, which is a reprint from the *Bath Chronicle* —a newspaper having extensive circulation in the Cider Counties of the West of England, the editor of which copied it from the *Hereford Journal*, and struck it off for gratuitous distribution, and to whose obliging courtesy I am indebted for the copy I send you:

"CIDER.—T. W. Booker, Esq., M.P., recently addressed a letter to the *Hereford Journal*, stating that his relative, Mr. Blakemore, of the Leys, Herefordshire, had, sometime before, conversed with a German Baron, who has large estates on the banks of the Rhine, where hock and other celebrated wines are produced, and that the Baron said that many sorts of the Herefordsire apples were capable of producing as valuable and desirable a beverage as the hock grapes, if a different process of making the liquor were adopted. The result of the Baron's observations is contained in the following extracts from Mr. Booker's letter:—

"Our liquors,' said the Baron, 'after the fruit is pressed, are strained, so as to separate the course muss from the liquor, which is then put into large vessels, when shortly afterwards fermentation commences. This fermentation we watch with the utmost care and attention, considering that upon it everything depends connected with the future quality and richness and value of the wine; in the course of a few days, the finer muss that remains in the liquor after the straining above alluded to, drops to the bottom, and the liquor becomes perfectly clear and transparent, retaining all its original saccharine matter, with all its strength, richness, and flavor. At this critical period, upon which we consider the quality of our wines depend, we adopt the process of racking. This racking must be effected in such a manner as to prevent any part of the liquor coming into contact with the atmospheric air; should it do so, fresh fermentation, in all probability, will take place, and by the same means, the like causes repeated will operate and be followed by the same results—repeated fermentation—until the flavor and richness of the origina, liquor are destroyed, and the liquor, instead of becoming winel would become as worthless as your inferior cider.' "

"The reason for this Rhenish caution (writes Mr. Booker) in preventing the liquor from coming into contact with the atmospheric air during the process of racking, is this. The first fermentation is what is termed vinous fermentation, and results in the liquor subjected to it becoming wine, if repeated fermentations are allowed to follow, they are what are termed acetous fermentations, and they result in the liquor parting with its vinous and saccharine properties, and imbibing acid or acetous ones, and it is converted into vinegar. Now the atmosphere is the laboratory from which the liquor absorbs the chemical agent which produces these distinct and separate fermentations.

"And now practically to apply these observations. One fermentation is all that is wanted to convert the juice of the apple into wholesome cider.

"The plan to ensure this which I recommend is as follows:— First—Grind the apples in the cider-mill, and squeeze the juice from the pulp, as is done at present. Second—Run or pour the liquor, after being squeezed or strained, into a vat, capable of containing three or four or even more hogsheads. This vat must be placed in an elevated position, at least five or six feet above the floor, to admit the hogshead or cask, in which the liquor is to be ultimately secured, to be placed under it. At the bottom of the large vat let there be a hole of from one-and-a-half to two inches in diameter, for the purpose of a tube being passed through this hole into the hogshead or cask under it. This tube or pipe should be of a sufficient length to pass through the muss or sediment which deposits itself in the large vat, and to reach at least six inches above it into the clear liquor, and it should be of sufficient length to pass through the hogshead or cask placed below or under the vat, into which the liquor is to be passed, nearly to the bottom. While this process of fermentation is going on, the top of this tube should be corked or plugged up. When the liquor in the vat has dropped fine, the cork or plug being withdrawn, the process of racking commences and is accomplished, and the fine liquor will run from the large vat through the tube into the hogshead or cask placed under it, the liquor retaining all its original saccharine qualities.

"And now the work is done; and the result will be found to be a liquor wholesome and palatable, full of spirit, richness, and flavor, and of value proportioned to the descriptions or sorts of apples which are cultivated in our orchards. My own firm conviction is, that the difference in value, in the market, of all the cider produced in Herefordshire by these simple means, over and above that produced by our present careless and slovenly means, would amount to many tens of thousands of pounds a year, and would be so much clear gain and profit to all those who make cider, to say nothing of the health and pleasure of those who drink it."

Since I wrote the foregoing, I have been favoured by a highly-valued and intelligent friend of mine, resident in our county, with the following admirable "Treatise on Cider-making:" it was written many years ago for the Farmers' Club at Ross, and is so comprehensive, and full of the most practical information, and, moreover, gives it in so much better language than any I can use, that I feel I cannot do better than place it before the public.

"The production of good cider must depend upon the description of fruit of which it is made, the season, and state of the apples when they are crushed, and the management of the juice whilst it is fermenting. It will therefore be proper to consider the subject under these three heads separately.

The kind of Apple which makes the best Cider.

"The acid which gives the peculiar quick and sharp feeling upon the palate in good cider, having first been noticed in the apple, although it exists in many other fruits, has been termed malic acid. It may not be too much to say, that it is the due combination of this acid with saccharine matter, namely, the sugar of the apple, properly fermented, which is the object to be aimed at in the manufacture of cider. In the selection of the fruit will depend the proportion of malic acid contained in the liquor. The crab has a much greater quantity of this acid than the cultivated fruit; and, generally speaking, in proportion as we obtain sweetness by culture, we deprive the apple of its malic acid.

"Hence it follows that some delicious table fruits will not

make good cider; this rule, however, is not invariable, as the golden pippin and some other fine apples appear to contain the proper admixture of acid and sweetness which is desirable in the liquor. Mr. Knight recommends that the different sorts of fruit be kept separate; and considers that only those apples which are yellow, or mixed with red make good cider; and that the fruit of which the fresh or rind is green, are very inferior. He recommends that the apples should be perfectly ripe—even mellow, but never decayed—before they are crushed.

"There was a curious manuscript written by Dr. John Beale, a fellow of the Royal Society in 1657, upon the subject, of which the following are extracts:—'Crabs and wild pears, such as grow in the wildest and barren cliffs, and on hills, make the richest, strongest, the most pleasant, and lasting wines that England yet yields, or is ever likely to yield. I have so well proved it already by so many hundred experiments in Herefordshire, that wise men tell me that these parts of England are some hundred thousand pounds sterling the better for the knowledge of it.' He mentions of these kinds of austere fruit the Bromsbury crab, the Barland pear, and intimates 'that the discovery of them was then but lately made, yet they had gotten a great reputation.' He adds, 'the soft crab and white or red horse pear excel them and all others known or spoken of in other counties.' Of the red horse pear of Felton or Longland, he says. 'that it has pleasant masculine rigour, especially in dry grounds, and has a peculiar property to overcome all blasts. Of the quality of the fruit he observes, 'such is the effect which the austerity has on the mouth on tasting the liquor, that the rustics declare it as if the roof of the mouth were filed away, and that neither man nor beast care to touch one of these pears, though ever so ripe.' Of the pear called rinny winter pear, which grows about Ross, in that county he observes, 'that it is of no use but for cider; and that if a thief steal it, he would incur a speedy vengeance, it being a furious purger; but being joined with well chosen crabs, and reserved to a due maturity, becomes richer than good French wine; but if drunk before the time, it stupifies the roof of the mouth, assaults the brain, and purges more violently than a Galenist."

"Of the quality of the liquor he says, 'according as it is managed, it proves strong Rhenish, Barrack, yea, pleasant Canary, sugared of itself, or as rough as the fiercest Greek wine, opening or binding, holding one, two, three, or more years, so that no mortal can say yet at what age it is past the best. This we can say, that we have kept it until it burn as quickly as sack, draws the flame like naptha, and fires the stomach like *aqua vitæ.*' Thus there appears a great difference between the opinions of these two men, who probably paid more attention to the subject than any others; and the question naturally arises, is the cider and perry of the country as good or better than it used to be, after greater attention has been paid to the orchards? I am decidedly of opinion that it is inferior; and it was this impression which caused me to venture to call your attention to the subject. If such be the case, it is a great object to ascertain what has caused the deterioration in the liquor. I believe it is for want of a due proportion of the peculiar acid which is found in the greatest quantity in the wild fruit; and beg to suggest whether it would not be worth while to try back, and mix a certain quantity of crabs with the fruit before it is crushed.

The best time of the year for making Cider.

"It has been before observed, that Mr. Knight recommends the fruit to be perfectly ripe, even mellow, before it is crushed, and this can only happen late in the autumn. As it is known to be more difficult to manage the fermentation of the liquor in warm weather, it is usual to defer making cider till November or December: if, however, the liquor can be put in a cold cellar after the first fermentation is over, I am of opinion that it might be commenced earlier. The juice of unripe fruits ferments more quickly than of that which is ripe, and contains more malic acid. Where there is the convenience of a good underground cellar, the difference of temperature between that and the outward air is greater in moderately warm weather than in November; so that if the liquor were fermented under sheds, as Mr. Knight recommends (and his instructions as to the management of the cider whilst fermenting are excellent,) and, as soon as fine, removed into the cold cellar, the change of temperature would be greater at the end of September than in November, and this would probably tend to prevent the liquor fermenting again. If the new cider cannot be removed, from the warmth of the atmosphere, there can be no question that is better to defer making till the weather becomes cool.

Fermentation of the Juice.

"The researches of scientific men, although very elaborate, have done very little in throwing light on the subject of fermentation; it appears to partake, in a measure, of the vital principle, of the phenomena attending which we know nothing. Many curious and interesting facts have been discovered during the investigation, but none of which appear to be of much use in the making of cider. There are three kinds of fermentation, or rather there are some products which pass regularly through three stages of fermentation, viz., the vinous, the acetous, and the putrescent. Other substances pass at onceto one or other of the latter stages; gum and water turning to vinegar without forming any spirit, and meat at once putrefying. It is not desirable that the vinous fermentation should be complete in the manufacture of cider, in which case all the sugar of the apple would be converted into spirit; this never does happen without a portion of vinegar being also formed, the acetous fermentation going on conjointly with the vinous, as when cider frets a great deal it may be very strong, but is comparatively of little value, having lost all its richness and become sour. The vinous fermentation stops naturally before it has run its course, and it is the object of the maker, to avail himself of this property in the liquor, and to endeavour to prevent any secondary fermentation taking place; the number of schemes which have been suggested to prevent which, showing that it is the most important point to be attended to in the manufacture of good cider. I am of opinion that the 100-gallon cask is much better than larger, and that the liquor is not only more easily managed, but more likely to be good; it may be that cider in large casks becomes stronger, but not so frequently rich as in single hogsheads. Although it may not be apparent, fermentation commences as soon as the juice is expressed from the fruit; and the sooner the cask is filled and allowed to remain quiet, the more regular and certain will be the process. What should we think of the brewer who, whilst his beer was working, brewed another quantity, and added the raw wort to the first? Yet this is constantly done in filling a large cask with cider; or even worse, for the apple juice is added cold, whereas the wort might be mixed with the beer whilst warm. It would be greatly better to keep the liquor in open tubs, till enough be obtained to fill the cask, and then to put it together at once.

"If I may be allowed to suggest an experiment, there is one use to which I should be very glad to see a large cask applied; that is, to fill it partly with *fresh* muss, and the remainder with boiling water—the probable result would be a very pleasant and useful liquor. Temperature has much to do with fermentation,

and it would be an advantage to have two cellars, one much colder than the other. If the liquor, upon pitching fine, were racked in a clean cask and put into a cold cellar, there would be much less risk of its fermenting again. I should recommend no other liquor to be added to it; but, in order to prevent ullage, that it should be racked into a smaller cask;—the less air admitted the better, and if the cask be sound and iron-bound it may be better to close it at this time.

"The application of cold will check fermentation immediately. I have seen liquor in a state of froth boiling out of a large jar, suddenly reduced to a state of quiescence by pumping on the side of the jar. This fact induced me to cause an experiment to be tried at Gayton during a very bad season for the cider making the weather being very warm; a cask of juice was rolled into a brook of cold water, and sunk by stones attached to it; it remained in that position till nearly Christmas, and was so much better than any other made that year that Mr. Newman obtained double the price for that hogshead he did for any of the rest. Perfect stillness is very desirable, as motion is found to excite the acetous fermentation. A bottle of wine, attached to a sail of a windmill in motion was, after three days, converted into vinegar, although closely corked. When a second fermentation does take place in cider, there is very little hope of its being rich and good.

"In such case, I should recommend its being drawn out into tubs, exposed to the cold as much as possible; and after being thus flattened, put back into the cask, at the same time well stirring up the whites of fifteen or twenty eggs, previously mixed up with a portion of the liquor; if this succeeds in fining it, which probably it will, it may then be racked into a clean cask, and closed as much as possible from the air. It is probable that a great deal of mischief is caused by some principle of fermentation remaining in the case; this might be prevented by well scalding the casks before they are filled: or, what I think would be better, by washing out the casks with clear lime water. One large piece of lime put into a hogshead of water, and allowed to settle would answer the purpose. Some brimstone matches burned in the casks would have a tendency to prevent fermentation.

"I shall not say much upon the mode of crushing the apples and pressing out the juice, having had so little practical experience; but I have always thought that if the fruit were crushed between wooden rollers, and allowed to drain before being put under the stone, the process would be much expedited; as the apples sometimes roll before the stone a long time before they are broken.

"In Ireland they use a press formed by a lever, which might be made at less expense than with a screw, and be more quickly worked: it is impossible the pressure can be too light at first, and it should be increased gradually as the liquor runs from the muss. Two sets of bags, allowing one to drain some time without pressure, would be an undoubted advantage.

"E. P."

I need not, I think, add one word to the advice here given. I earnestly hope it will be followed, and sure I am that we shall all feel and acknowledge the value of it, in the improvement in quality, and increase in value, of our county beverage.

I have been asked by hundreds whether it is really the fact that during each visitation of that awful scourge, the Cholera, which has again appeared among us, not a single case has ever yet occured in Herefordshire: my reply has been *that it is so: I shall be glad to be corrected if I am wrong:* if I am right, the knowledge of this cannot be too widely circulated, nor can our thankfulness be too great to the Almighty Being who has so singularly and signally blessed and protected us.

Description of some New Kinds of Galvanic Batteries.
*Invented by Mr. Kukla, of Vienna.**

The combination used in one of these, is antimony, or some of its alloys, for a negative plate, with nitric acid of specific gravity 1·4, in contact with it, and unamalgamated zinc, for a positive plate, with a saturated solution of common salt in contact with it. A small quantity of finely powdered per-oxide of manganese is put into the nitric acid, which is said to increase the constancy of the battery. The alloys of antimony which Mr. Kukla has experimented with successfully are the following:—Phosphorus and antimony, chromium and antimony, arsenic and antimony, boron and antimony. These are in the order of their negative character, phosphorus and antimony being the most negative. Antimony itself is less negative than any of these alloys. The alloys are made in the proportions of the atomic weights of the substances. All these arrangements are said by Mr. Kukla to be more powerful than when platinum or carbon is substituted for antimony or its alloys. In this battery a gutta percha bell cover is used over the antimony, and resting on a flat ring floating on the top of the zinc solution,—this effectually prevents any smell, and keeps the per-oxide of nitrogen in contact with the nitric acid solution. When a battery of twenty-four cells was used, Mr. Kukla found that in the third and twenty-first cells pure ammonia in solution was the ultimate result of the action of the battery; but only water in all the others. This experiment was tried repeatedly, and always with the same result. A battery was put into action for twenty-four hours; at the end of that time the nitric acid had lost thirteen twentieths of an ounce of oxygen, and one quarter of an ounce of zinc was consumed.

Now as one-quarter of an ounce of zinc requires only 0.06 of an ounce of oxygen to form oxide of zinc, Mr. Kukla draws the conclusion, that the rest of the oxygen is converted directly into electricity; and this view, he says, is confirmed by the large amount of electricity given out by the battery in proportion to the zinc consumed in a given time. In the above battery each zinc plate had a surface of forty square inches. The addition of per-oxide of manganese does not increase the effect of the battery, but it makes it more lasting—the per-oxide of nitrogen, formed in the bell cover, taking one atom of oxygen from the per-oxide of manganese;—this is evident from only the oxide of manganese being found in the battery after a time: in the salt solution no other alteration takes place than what is caused by the oxide of zinc remaining in a partly dissolved state in the solution. For this battery Mr. Kukla much prefers porous cells, or diaphragms of biscuit ware, as less liable to break, and being more homogeneous in their material than any other kind. This battery is very cheap, antimony being only *5d.* per lb., wholesale, and the zinc not requiring amalgamation.—The second arrangement tried by Mr. Kukla was antimony amalgamated zinc with only one exciting solution, viz. concentrated sulphuric acid:—this battery has great heating power, and the former great magnetizing power—it, however, rapidly decreases in power, and is not so practically useful as the double fluid battery, which will exert about the same power for fourteen days, when the

* Athenæum.

poles are only occasionally connected as in electric telegraphs. Certain peculiarites respecting the ratio of intensity to quantity when a series of cells is used, have been observed, which differ from those remarked in other batteries.—Mr. Kukla, on directing his attention to the best means of making a small portable battery for physiological purposes has found very small and flat Cruikshank batteries, excited by weak phosphoric acid (one of glacial phosphoric acid to twenty of water,) to be the best, phosphoric acid being very deliquescent, and forming with the zinc during the galvanic action, an acid phosphate of zinc. A battery of this description does not decrease in power very materially until it has been three hours in action.

Robert Stephenson, M.P.

(*Continued from page* 100.)

In company with Mr. G. P. Bidder, (now General Superintendent of the Grand Trunk Railway of Canada,) Mr. Robert Stephenson visited Norway in 1846, for the purpose of examining that country, with a view to the Construction of a Railway between Christiana and the Myosin Lake, a distance of about forty miles. To mark his appreciation of Mr. Stephenson's services on this work, the King of Norway and Sweden confered upon him the Grand Cross of the Order of St. Oliff. We are not in a position to describe the nature of the works on the forty miles of Railway, but either the Order of St Oliff must be of cheap acquirement:—or if honorary rewards are there distributed in the same ratio to merit as they are in England and America, the works on this Norwegian line must have been of tremendous difficulty.

In England, Mr. Stephenson took an active part in the "War of the Guages," which in 1845-6 created so much excitement in the Railway world, and determined the future connections and distances of the Railways of Great Britain. In this contest as to the relative merits of wide and narrow ways, Mr. Stephenson took the lead in supporting the interests of the narrow Guage. The Railway Guage of Canada has been settled, apparently to the satisfaction of every one, unless, the proprietors of the Great Western are an exception; and this once momentous question, has therefore, little interest here; it may not be amiss however, considering the prominent position occupied in the contest by the subject of this Notice, to examine briefly the arguments by which he supported his views of that question, and those of his principal opponent.

As will readily be surmised, the Gauge of 4 feet 8½ inches, the narrow Gauge of Europe and North America, was not originally adopted from any inherent advantages offered by that fractional measure, but like many other empirical proportions, owes its origin to some Cart-wheelwright in the neighbourhood of Newcastle upon Tyne, where Tram Roads had their birth, and at a time when half an inch more or less, possessed less value in the eyes of a Mechanic, than at the present moment; gradually Railways developed themselves in the same section of country, and their width was ruled not by the convenience of this age, but by the rolling stock of the old Tram Roads; hence, as Robert Stephenson says in his evidence, speaking of the 4 feet 8½ inches Gauge of the Manchester and Liverpool Railway;—"It was not proposed by my Father, it was the original Guage of the Railways about Newcastle, on Tyne, and *therefore* he adopted that Guage." And so of the Grand Junction Railway, and the Manchester and Leeds Railway, he says, "After the Liverpool and Manchester line had been established, it was quite apparent that all the lines in that neighbourhood must work into it, in order to get to the port of Liverpool, and it was considered imperative in fact, that the Guages should be all the same." Then of the North Midland, of which he himself was the Engineer and proposed the Guage, he says, "There was a part of the line common to both the Manchester and Leeds, and North Midland: and the Manchester and Leeds, having been fixed with a view of eventually working into the Manchester and Liverpool, of course, it became equally a matter of consequence, that the North Midland should be of the same Guage." Again, the Derby Junction line, being "in point of fact a continuation of the North Midland to Birmingham; it was made of necessity of the same Guage as the North Midland:" the London and Birmingham, with a view to connect with the Grand Junction, was next fixed with the same Guage, and "Uniformity was the principal reason for its adoption." For similar reasons, the narrow Guage was adopted as the Railway system was extended, and it daily became of more importance to proprietors that it should not be changed.

Thus, reasons originally of no value, gradually acquired force; until in 1846, they were almost irresistable, and though a period did arrive, when it became evident to Mr. Stephenson as an Engine Builder, that a few more inches of space between the wheels would have been of great value; yet he considers that "since that time, the improved arrangements in the Mechanism of the Locomotive Engine, have rendered that increase altogether unnecessary; at present with the inside cylinders; which is the class of engine requiring the most room between the rails; and the cranked axles with four eccentrics, we have ample space and even space to spare." These improvements he describes:—"in the arrangement of the Machinery, which is the main question, having reference to the width; the working gear has been much simplified, and the communications in the most recent engines, between the eccentric and the slide valve, have been made direct communications: whereas it was made formerly through the intervention of a series of Levers which occupied the width." * * "Then with reference to the increase of power, the size of the Boiler is in point of fact, the only limit to the power, and we have increased them in length on the narrow Guage, because we have always made the boiler as wide as the narrow Guage would admit of; but we have increased the power by increasing the length, both in the fire-box and in the tubes; we have obtained economy I conceive by lengthening the tubes, and we have obtained an increased power, by increasing the size of the fire-box; in fact the power of the engine, supposing the power to be absorbed, may be taken to be directly as the area of the fire-grate, or the quantity of fuel contained in the fire-box." * * I conceive the steadiness of the Engine to be very much increased by increasing the length, for the unevenness of the road is met by that, by increasing the length of the base, you increase thereby the steadiness," * * "as you increase the length, that is, the distance between the fore and hind axle, they are less liable to get off the rails in consequence of moving more steadily than the short engines on four wheels, where the base is the same width, by about 7, 8, and 9 feet, originally they were about 7, and 7 feet 6 inches, and 8 feet. The large weight hanging over the axle behind was exceedingly liable to make the engine oscillate with great violence, whenever it came to an inequality. I have known engines of that class actually lift the front wheels off the rail, one accident might be referred to that, though there may be a difference of opinion as to the actual cause of the accident, but in several cases I have attributed accidents to the engine, in the case of a slight imperfection of the road, being

liable to such oscillation as to lift the front wheels, or at least to take the weight of them so as to render them useless as guides."

We have quoted this part of Mr. Stephenson's evidence as elucidating his improvements of the Locomotive, and as illustrating the fact that the great improvements on American built Engines have been based, if not directly on these opinions, certainly on similar ones, and that they embody these identical principles as fully as any engine manufactured under Mr. Stephenson's own eye. The American manufacturer has extended the base, and in so doing increased the stability, while the more frequent recurrence of short curves has driven him to the adoption of a contrivance which, while the length and base of the engine is increased, renders it much less liable to derangement on curves than the English engine. We refer to the truck frame, a feature characteristic of American engines, and without which many of the curves on our railways would be impracticable at high velocities.

Returning again to the width of guage we find Mr. Stephenson assigning as the reason for adopting the narrow guage on the London and Brighton Line, where a junction with no other Line was in contemplation, that he "felt that 4 feet 8½ inches were fully adequate for any purpose to which a railway could be applied; and believing also that the narrower the guage the less was the resistance. I conceived that that would prove safe and economical, and that there was no ground or reason for deviating from it." * * * "We believe the resistance in passing round curves to be materially affected by the width of the guage. We know that in the collieries about Newcastle, where the 4 feet 8½ inch guage prevails, wherever they come to any mining operations, where the power to be used is that of a horse or man, they immediately reduce the guage, because they want to go in or out amongst the mines with very sharp curves, and the wide guage would be quite impracticable amongst them. In fact the small carriages that are used in the mining operations are upon a guage of about 20 inches, and they go round curves under ground of about 10 or 12 feet radius, and they could only work such mines by such a guage. In the case of every guage when you come to a sharp curve, you see the outside and inside rails quite brightened by the sliding motion, because the one set of wheels has to slide forward to keep pace with the other, and the others have to slide backwards. In fact, when going round a curve both operations have to take place—the sliding backwards of the one set, and the sliding forwards of the other. Of course as you increase the width of guage the difference between the two becomes augmented, and I think the increase of resistance in a case of that kind would be found to be as the square of the guage, because the increased space that you have to slide over is as the width of guage, and you have to accomplish that in the same time as on the narrow guage: therefore it is in my opinion increased as the square."

As bearing more directly on the value of an uninterrupted guage over a considerable length of road, and as exhibiting his opinions of the value of a uniformity of guages on lines, worked in connection with each other, the reasons which influenced Mr. Stephenson to recommend the change of the Eastern Counties' Line, which had been laid down by Mr. Braithwaite, on a five feet guage, to the ordinary narrow guage of 4 feet 8½ inches will possess some interest, we therefore quote his evidence on that particular: "It became a question," he says, "after having decided upon the Northern and Eastern being altered, which was the only one leading up into the Counties already occupied by the narrow guage, whether we should alter the Eastern Counties' guage which was laid down for fifty miles to Colchester into a district of country where the junction of different guages would have been of less consequence, and indeed was little likely to take place, because the Eastern Counties is apart from any other Line almost in the Kingdom. * * * I was quite aware that there would be some difficulty in the first instance in trying to blend two guages together in the same Station; but I had no idea until we went into detail what those difficulties would amount to. Then there was another reason why we decided upon altering it, (the 5 feet guage) in fact we found that the two Lines would require two complete, separate, carrying establishments, we could never make use of the carriages of one Line upon the Line of the other, which we find to be really of vital consequence just now. * * * If they had had two carrying establishments, I consider that they would have spent far more money in the carrying establishment (that is £50,000) than they have spent in altering the guage, and when done the carrying establishment would not have been so effective."

These opinions are of course predicated with reference to the blending of two short Lines, and are irrespective of the consideration of how far railway stock can be run without thorough examination and repair; but on this Mr. Stephenson subsequently expresses his opinion that carriages might be run from Euston Square to Glasgow or Edinburgh without change or requiring repair. He says, "The carriages are now, from our experience, become so substantial and so secure and efficient in the arrangements that they run 400 or 500 miles very frequently, and in fact, I dare say, a great many carriages run a great many thousand miles without having any thing done to them except greasing."

Had Mr. Stephenson observed at any time a serious objection to the narrow guage of 4 feet 8½ inches, he would doubtless have changed it, when called upon to advise with reference to the construction of the Belgian Railways, where no considerations of future junctions with established Lines had any weight in determining the guage to be adopted; he says in reference to these Lines: "There of course there was a new field open to us, and it would have been competent to introduce a wider guage or a narrower one, just as our experience might dictate; but we had no reason whatever to urge upon them an alteration from that guage which has already been established in this country, and which seemed to answer every purpose without the least objection. The other Line that I was connected with was the Leghorn and Pisa. There of course again we were in a new country, and it was quite competent to alter the guage if it had been deemed necessary. * * * Perhaps if I had been called upon to do so it would be difficult to give a good reason for the adoption of an odd measure, 4 feet 8½ inches; but inasmuch as an inch or two more or less would have involved a different construction of engines on a new model or pattern, I followed it." Similar reasons doubtless prevailed with the engineers of the first Lines of Railway constructed in America, and thus we trace the influence of the old colliery tram roads as fixing the prevailing guage of the Railways of the world; and what is most singular the leading advocates of that guage have failed to offer to our notice any advantages possessed by it over other guages, and we doubt whether any machinist who might be called upon to design a locomotive of the power of our present first class engines, and entirely irrespective of any fixed guage or existing model, would approach within several inches of that particular measure. There is doubtless a limit to the width of guage that can be adopted with advantage, and we will now quote Stephenson's reasons for objecting to so wide a guage as that adopted by Mr. Brunel for

the Great Western of England. With reference to which, he says, "I am not aware of any advantage whatever that it has. It has I think several disadvantages. The first of course is the additional expense of construction. It requires embankments and cuttings four feet wider, in consequence of the guage. * * * Their tunnels are of course necessarily increased beyond what is sufficient for the narrow guage. The narrow guage tunnels are twenty-four feet wide, that is six feet between the rails, and four feet between the rail and the wall of the tunnel; that makes twenty-four feet. Now of course to give the same space between the rails, and the same space between the outside rail and the wall, it requires the wide guage tunnel to be four feet wider. * * * *

(To be continued.)

Views on the Origin of Terrestrial Magnetism.*

The earliest view of terrestrial magnetism supposed the existence of a magnet at the earth's centre. As this does not accord with the observations on declination, inclination, and intensity, Tobias Meyer gave this fictitious magnet an eccentric position, placing it one-seventh part of the earth's radius from the centre. Hansteen imagined that there were two such magnets, different in position and intensity. Ampere set aside these unsatisfactory hypotheses by the view, derived from his discovery, that the earth itself is an electro-magnet, magnetised by an electric current, circulating about it from east to west, perpendicularly to the plane of the magnetic meridian; and that the same currents give direction to the magnetic meridian, and magnetise the ores of iron; the currents, being thermo-electric currents, excited by the action of the sun's heat successively on the different part of the earth's surface as it revolves towards the east.

A long time before the discovery of electro-magnetism, Biot was occupied with this subject, and regarded the terrestrial magnetism as the principal resultant of all the magnetic particles disseminated in the earth. M. Gauss adops this view, as an interpretation of the fact, without explaining it. An observation which I made some years since along with one of my brothers† has directed my attention to this subject. It related to the fall of a cylindrical meteor whose position was sensibly in the plane of the magnetic meridian. Many luminous meteors have been observed in this same position or near it, if I may judge from some of those described in the catalogue of Borguslawsky.‡

The special position of the meteor observed by my brother and myself was not fortuitous; it was determined by the magnetic action of the earth, an action which may be powerful in its influence on meteorites consisting essentially of the magnetic metals, iron, and nickel. In our view, the terrestrial magnet, the earth, decomposed by its influence the normal fluid of the meteoric mass, and so gave the meteor thus polarized the direction of a compass-needle.

In generalising from this fact, and recalling the experiment of Arago on the magnetism developed when a magnet acts upon a turning disc, we ask whether the magnetic polarity of our planet may not be due to a like cause. Considering it, as proved, that the sun is polarized magnetically like the earth,§ the sun will then be the inductor magnet, the agent which decomposes the magnetic fluid of the terrestrial globe; it will be to the earth, what the earth was to the meteor. This explanation does not resolve the difficulty, as it does not say whence comes the magnetic polarity of the sun. It implies the intervention of a magnet whose intensity is superior to that of the sun, acting on this last by induction, and impressing a polarity which the sun transmits to other planets of the system. It is the hypothesis reversed of the central magnet, for it places in space the magnetic mass which some physicists have supposed to exist within the earth.

The real cause of the magnetic polarity of the planets, is in my view the same for all, and Arago's experiment conducts to it in a straight line. It results even from the condition of their existence. Each star turning around a central axis, and in determinate curves, is influenced by the mass of these stars and their velocity at the circumference; in a word, the agent decomposing into two fluids the normal magnetism of the earth and the other planets, is their rotation. A geometer examining this opinion, would find, we believe, that the declination, inclination and the perturbations of the magnetic needle, are explained on this hypothesis much better than on any other.

Since my researches on circular electro-magnets and in general on bodies in rotation, I have sought much for experimental demonstration of this theory, and have now the conviction that this is impossible, as it is not possible for us while upon the earth to remove ourselves from the action of its own magnetism. Whenever a development of magnetism under the influence of rotation is observed, it is common to attribute it to the inductive action of the earth, rendered so striking by the experiments of Arago and Mr. Barlow.

Alongside of the different sources of magnetism mentioned in Treatises on Physics,—friction, pressure, percussion, torsion,—we should add rotation, a mechanical action of equal title with the preceding, and whose effects, produced through a subdivision like that of magnetic polarity, are found grouped at the extremities of the axis in rotation; in the same manner as the poles develope at the extremities of a bar of iron when it is subjected to torsion.

* Silliman's Journal, correspondence of J. Nickles.

†Poggendorff's Annalen, vi. 1.

‡ See Proceedings, Brit. Assoc., 1853, Sept. 7, Report of Col. Sabine.

§ Sur la chute d'ume bolide par M. N. Nickles and J. Nickles, Compt. Rend. de l'Acad, xix. 1085.

Ingenious application of Science and its Results.

A very ingenious application of scientific principles to determine the point of fusion in a closed vessel, and a remarkable result from high pressure on fluids, were incidently mentioned by the President of the British Association in his inaugural address. Experiments were instituted by Mr. Hopkins, Mr. Fairburn, and Mr. Jowle, to determine the effects of increased pressure in raising the temperature of fusion. The substance operated on was inclosed in a very strong metal chamber, and the pressure was produced by water forced by a plunger acted on by a long lever down an iron tube, three quarters of an inch thick. Wax was the substance employed; and it was of course essential to ascertain the exact moment that it became fluid when heat was applied. As all the apparatus must necessarily be opaque, the melting point could not be seen. The difficulty was ingeniously surmounted in the following manner: a small magnet was enclosed on the top of the wax, whilst outside the metallic chamber containing it, and on the same level, a nicely-balanced

magnetic needle was placed. The enclosed magnet acted on the needle and deflected it, at a certain angle, from its natural position; but the instant that the wax melted, the magnet fell to the bottom, and the vibration of the needle indicated the fact. It was thus ascertained that under a pressure of thirteen thousand pounds on the square inch, wax requires thirty degrees additional heat to melt it; about one-fifth of the whole temperature at which it melts under the pressure of the atmosphere.

During the experiment, it was observed that the plunger gradually descended in the tube, and on examination it was discovered that the water had, under the influence of the enormous pressure, been forced through the pores of the iron, though three quarters of an inch thick. On afterwards examining the tube closely with a lens, not the least opening could be seen by which the water could have escaped. This result far exceeds that of the celebrated Florentine experiment, by which the incompressibility of water was supposed to be proved by its forcing a passage through the pores of a globe of silver, very thin in comparison with the three-quarter inch iron tube. It was not ascertained whether any of the melted wax had been forced into the pores of its containing vessel.

INCORPORATED BY ROYAL CHARTER.

Fourth Ordinary Meeting, January 14th, 1854.

The following Donations to the Museum and Library of the Institute were announced :

1.—A number of Minerals and Fossils from Ireland and Canada, by Thomas Herrick.

2.—Indian Relics by Dr. Richardson.

3.—Hay's Book of British Birds by Mr. Hope.

The thanks of the Institute were ordered to be presented to Mr. Thomas Herrick, Dr. Richardson and Mr. Hope, for their valuable donations.

The names of the following Candidates for Membership were read:

Leslie Battersby, (Jun. Mem.)	Toronto.
Hon. S. B. Harrison,	"
D. Macdonell	"
Rice Lewis	"
A. M. McKenzie, C.E.	Guelph.
Hon. J. H. Cameron, Q.C.	Toronto.
George Netting	"

The following Gentlemen were elected Members:

F. A. Whitney	Toronto.
J. W. G. Whitney	"
C. H. Jarvis	"
Rev. E. St. John Parry	"
J. Small, M.D.	"
Capt. C. R. Scholefield	"
J. E. Small	"

A Paper was read by A. Brunel, C.E. on "The Comparative advantages of Single and Double Track Railways."

Fifth Ordinary Meeting, January 21st, 1854.

A Donation from Capt. Lefroy, R.A. F.R.S. of "A Map of the British Provinces in North America, drawn in 1776," was announced.

The names of the following Candidates for Membership were read:

P. M. Vankoughnet, Q.C. (Life Member)	Toronto.
Joseph Workman, M.D.	"
William Hallowell, M.D.	"
Hewson Murray (Jun. Mem.)	"

The following Gentlemen were elected Members:

Leslie Battersby	Toronto.
Hon. S. B. Harrison	"
D. Macdonell	"
Rice Lewis	"
A. M. McKenzie, C.E.	Guelph.
Hon. J. H. Cameron, Q.C.	Toronto.
George Netting	"

A Paper was read by Mr. G. H. Dartnell, on "The Duration and Expectation of Life in Canada."

Sixth Ordinary Meeting, January 28th, 1854.

The names of the following Candidates for Membership were read:

James Edwin Ellis	Toronto.
Agustus J. Thibodo, B.M.	Kingston.
G. P. Ure	Toronto.

Notice was given by Mr. D. Crawford, that at the second General Meeting from the present, he would move for an alteration in the Bye-Law relating to the Balloting for Members.

The following gentlemen were elected Members:

P. M. Vankoughnet, Q.C.	Toronto.
Joseph Workman, M.D.	"
William Hallowell, M.D.	"
Hewson Murray, (Jun. Mem.)	"

A Paper, communicated by W. E. Logan, F.R.S. & G.S. Provincial Geologist, "On the Physical Structure of the Western District of Upper Canada," was read by Professor Croft.

The Paper was illustrated by a geological map of a portion of Upper Canada, and with a section of the country between Lakes Huron and Erie. It is the intention of the Council to publish Mr. Logan's valuable Paper, together with the accompanying Map and Section.

The thanks of the Institute were ordered to be presented to Mr. Logan for his important Paper, and the valuable Maps which accompanied it.

The Royal Society and the Canadian Institute.

We have much pleasure in calling the attention of the members of the Canadian Institute to the following Minutes of the Council of the Royal Society. The advantage and importance of receiving early impressions of the proceedings of the most distinguished Scientific Society in the British Empire, and perhaps in the world, cannot be too highly estimated.

Read the following letter from Captain Lefroy, addressed to the Secretary;

"Woolwich, October 27, 1853.

"Sir,—I have the honour to request that you will lay before the Council of the Royal Society, an application which I am authorised to make on behalf of the Canadian Institute of Toronto, U.C. for the privilege of receiving the Philosophical Transactions and Proceedings of the Royal Society.

"I beg to state that the Canadian Institute is a regularly incorporated Scientific Society, having a Royal Charter. A monthly publication called the *Canadian Journal* emanates from it, and although of very modest pretensions and still in its infancy, the Society has met with very encouraging success. It numbers over 300 members, distributed over every part of Upper and Lower Canada. It would greatly gratify its members, and add to their claims to the public support, were it to be honoured with this proof of the sympathy and encouragement of the Royal Society. Perhaps I may be permitted to remark, that while five copies are distributed in the United States, no Institution in British America appears, by the printed list, to be so honoured ; and I have reason to believe that only one Public Library (that of the Legislature at Quebec) contains the work.

"In thus applying on behalf of a Society in which I am personally interested, I am desirous at the same time of submitting for consideration a larger question ; namely, whether it may not be made a rule to supply single copies of the Philosophical Transactions, at a cost only covering paper, presswork, and binding, to all regularly incorporated Scientific or Literary Societies in the British Colonies that may conform to certain necessary conditions. Having passed the last thirteen years principally in the Colonies, I may be permitted to state, that in my humble opinion, everything which can strengthen their moral ties to the mother country is worthy the attention of all who value that connection. A measure of this comprehensive favour and liberality would be received with a grateful feeling by the most educated and enlightened classes of Colonial Society ; while its probable effect, if adopted generally by the great Societies, would be invaluable. The number of copies that might be claimed under such a rule would not, I think, exceed twenty at present, and I cannot but submit the measure, with much respect, as one it would be worthy of the Royal Society to adopt.

"I have the honour to be, Sir,

"Your most obedient Servant,

"J. H. LEFROY,

"*Captain R.A. F.R.S.*"

"*The Secretary, &c. &c. &c., Royal Society.*"

Resolved,—That Captain Lefroy be referred to the Officers of the Society to report on to the Council.

REPORT.

With reference to the Minutes of Council of the 24th November, containing a letter from Captain Lefroy, the Officers recommend that the Canadian Institute of Toronto should be placed upon the List of Institutions to which the Proceedings of the Royal Society should be presented. and that the Sheets of the Proceedings as they are printed be sent by post to an Agent in London, who may be appointed by the Canadian Institute to receive them.

If, further, the Canadian Institute be desirous to be supplied with the Philosophical Transactions at a low rate of purchase, the Officers recommend that advantage be taken of the privilege possessed by the Fellows of the Society of purchasing the volumes five years after their publication for one third of the cost price.

Resolved,--That the above recommendation be adopted.

The Canadian Journal.

The present number of *The Canadian Journal* is published by Thomas Maclear & Co., the successors to the Book and Stationery business of the late Hugh Scobie, Esq. We are assured that whatever defects may be observed in the typographical execution of this number, they will be remedied as soon as a fresh supply of type arrives from the manufacturers. The unavoidable derangement in the establishment of the late Publisher, during the long illness which preceded his decease, and the subsequent changes which occurred in the various departments of business over which he presided, will, we believe, satisfactorily account for, and excuse, the defects occasionally evident in the mechanical execution of some late numbers. Arrangements are now being made to publish the Journal on the 1st instead of the 15th of the month, as heretofore.

Want of space prevents the insertion of descriptions of the Great Western, and the Buffalo, Brantford and Goderich Railways, which are now in operation; the former throughout its entire length from the Niagara River to Detroit: the latter from the Niagara River to Brantford. The same cause excludes for the present, the Prize List of the Canadian department at the New York Exhibition of the Industry of all Nations. These omissions will be supplied in the March number.

Notices of Books.

Elementary Chemistry, by G. Fownes, F.R.S. Edited by R. Bridges, M.D. Lea & Blanchard, Philadelphia.

There has scarcely ever appeared a Manual of any Science, that has acquired so high a reputation as "Fowne's Chemistry for Students." Appearing after the later editions of Turner's Elements, and the earlier ones of Graham & Kane, Mr. Fowne's work, the third edition of which was finished only a few days before his decease, has pretty universally taken the place of those works in England, and considering the very moderate price of the present American edition, it is sure to do so in this country.

The work particularly recommends itself by its accurate although necessarily very concise descriptions, the clearness of its explanations, and the simplicity of its arrangements, and is exceedingly well adapted for the use of students, serving as an introduction to the more comprehensive works of Gregory, Graham and Gmelin.

The last edition was published in 1849, and consequently the remarkable progress of chemistry during the last few years, especially as regards the history of the compound ammonias and vegetable alkaloids, as well as in many other departments, has rendered the publication of an amended edition a great desideratum among teachers. The fact of the present edition having been superintended by Bence Jones & Hoffman, will be a sufficient guarantee for the completeness of the work, and the notes of the talented American editor, Dr. Bridges, will be found of very considerable value, as bringing the work still more nearly up to the present period.

Having used the former edition, as text book for our Students for several years past, we can most cordially recommend the present one as giving a very excellent digest of the present state of chemical science, and as especially adapted to the wants of the Student.

Correspondence.

To the Editor of the Canadian Journal.

Sir,—In the summer of 1851, I took a beautiful species of bat, about 11 A. M., in the forest north of this city. It was suspended by the claws or fore feet, from a twig of a young maple tree. Knowing the animal to be rare in this locality, I took great care in preserving and stuffing it. On the 3rd instant, I sent it to Professor L. Agassiz of Cambridge, Mass., for the purpose of ascertaining whether it was a new species. From the learned Zoölogist, I received the following answer:—"The bat is a species not uncommon in the middle States, but I had supposed its farthest northernmost limit to be Massachusetts, which your specimen proves to be a mistake. It is *Vespertilio Noceboraensis*—you will find a description and figure of it in 'DeKay's Natural History of New York.' I am very much obliged for the specimen, which is beautifully preserved, and very interesting to me, as indicating the Geographical range of the animal." Linnæus in his "Systema Naturæ," says that the same animal inhabits New Zealand. There are reckoned upwards of thirty genera of this strange animal, and more than three hundred species. Eight indigenous species has been taken by myself. I have been told that a bat with a white body was seen last summer, flying about willow trees near the bay.

WM. COUPER.

Toronto, January, 1854.

Scientific Intelligence.

An Improved Material applicable for many purposes for which Papier Mache and Gutta Percha have been or may be used.

*Patented by Peter Warren. October, 12, 1852.**

This invention consists in manufacturing a new material or composition of a character analogous to papier maché, which is capable of being employed either as a substitute for papier maché or gutta percha, and its compounds, in forming or manufacturing various articles for which these substances are now used, such as panels and mouldings for railway carriages, trays, picture and other frames, door knobs, buttons, &c., by treating the straw of any fibrous vegetable material in the manner hereby described. In order to carry out this invention, straw of any fibrous vegetable substances, such as wheat, barley, oats, rye, and other similar straws are cut into short lengths, by means of any suitable cutting machine When those straws have any knots, it is necessary to open out and divide the same, which is effected by passing the straw through a pair of millstones, or between crushing rollers; or they may be submitted to the action of any other equivalent apparatus, so that the knots and fibres may be thoroughly and effectually separated and divided. In some cases, either hot or cold water or other liquid is applied to the materials under operation, in order to facilitate the process. The cut and divided straw is then boiled in a strong alkaline ley, or solution of caustic alkali, such as soda, potash, &c., until a pulpy mass is produced,—which effect will, however, greatly depend on the nature of straw operated on, and the strength of the alkaline ley, or solution which is employed. The mass is then transferred to the machine known in the paper making trade as the rag engine, where it is reduced to pulp in the manner usually practised when operating on rags, &c., in the manufacture of paper. The pulp is then partially dried; in which state it may be pressed or rolled into sheets, or moulded into other forms. These sheets or moulded articles are then dipped into oleaginous or glutinous matter, or oil, and are afterwards baked in an oven similar to that employed when manufacturing sheets or moulded articles of papier machè. The sheets or moulded articles, thus formed or manufactured, may be ornamented in any desired manner, either by japaning, or painting and varnishing, or by inlaying the surface with shell, or other analogous material, as is commonly practised in the ornamenting of articles composed of papier machè and gutta percha. When the sheets or moulded articles are required to be colored pigments or coloring matter might be introduced in the pulp while in the rag engine; the subsequent processes of drying, rolling, pressing, or moulding, being performed as previously described.

The patentee claims the manufacture of a material which may be used as a substitute for papier machè, and for many purposes to which papier machè and gutta percha have been or may be employed, from straw pulp submitted to pressure and then oiled and baked as hereinbefore described.

* From the London Repertory of Patent Inventions, Sept. 1853.

Rolled Sheets of Bitumen.

MM. Aumeteyer believe that they have made a valuable improvement in the use of bitumens, by submitting them to rolling. The bitumens, say they, have been proved as to their qualities and endurance; their water-repelling properties and impermeability cause them to be more and more sought for every day; but up to the present time, no one had thought of rolling them out, and reducing them to thin sheets, easily to be laid when cold, like zinc and lead. This new mode of treatment does away, in the first place, with the inconveniences of melting on the spot, which is so disagreeable; and it gives to the bitumens, besides, a density and solidity which they have not yet attained; it assures them an indefinite durability.

Thus prepared, bitumen will very advantageously replace slate, zinc, thatch, &c., as coverings for terraces, buildings, &c. It melts, but does not inflame; and would rather extinguish than nourish combustion. They are incomparably lighter even than slates, and are non-conductors both of heat and electricity; they cost less even than thatch, require no attention, and are in no way affected by atmospheric influences; they are impermeable to water, &c., &c. They will be of great service in rendering damp places healthy; they are applied without difficulty to walls, and adhere strongly; a cellar whose walls were covered with rolled bitumen or asphalte, would be as healthy and as habitable as the upper story, provided light finds access, and the air is sufficiently renewed. In water conduits, reservoirs, basins, baths, washing establishments, and silos for the preservation of grains and vegetables, these sheets of bitumen, so thin, yet as unalterable as metals, will be of immense service. Easily painted, they may be employed either for wall-hanging or for floors.—*Journal Franklin Institute.*

ADDITIONAL EXPERIMENTS ON THE INTERNAL DISPERSION OF LIGHT.—In a lecture delivered before the Royal Institution in London, Prof. Stokes has communicated some new observations on internal dispersion, which are of much interest. In accordance with an observation of Faraday, Stokes has found that the blue flame of sulphur burning in oxygen is a source of rays which exhibit the phenomena extremely well. Letters written upon white paper with a solution of chinin, immediately become visible when illuminated with this light, particularly when it has passed through a blue glass, although they are invisible in gas light. The letters remain visible when observed through a glass containing a thin layer of a solution of chromate of potash, but they instantly vanish when this glass is interpolated between the flame and the paper, the solution being impervious to the rays which occasion the color. The author points out in the next place the advantages which prisms and lenses of rock-crystal possess over those of glass, in experiments of this

kind, inasmuch as they readily transmit the invisible rays. By employing the light of the powerful galvanic battery of the royal institution, and lenses and prisms of quartz, the author obtained a spectrum six to eight times as long as the ordinary visible spectrum, and crossed from one end to the other with bright bands. The interposition of a plate of glass shortened the spectrum to a small fraction of its original length, the highly refrangible portion being entirely absorbed. The discharge of a Leyden jar gave a spectrum which was at least as long, but which was not perfectly similar to the others, as it consisted only of insulated bright bands. Stokes remarks finally that in winter, even in bright sunshine, he could obtain no such extended spectrum; as the spring advanced, the light constantly improved; he could not, however, see so far into the spectrum as at the end of last August. The Earth's atmosphere was evidently not transparent for the very highly refrangible rays of the suns light.—*Pogg. Ann.*, lxxxix, 627.

Telegraphic Inventions.—The *Official Venice Gazette* states in a special article, that the Olympic Academy of Vicenza, having carefully examined the discovery made by their fellow-citizen Tremeschini of electric telegraphy by secret transmission, has publicly declared it to be a successful invention. The commission appointed to test its efficacy was composed of the councillor-delegate, of the Podesta, the superior commissary, and the Academic council. The first experiment consisted in sending and receiving a despatch in the common way, without secresy. In the second experiment a despatch was sent secretly, and the answer received in the same manner, by the aid of the new apparatus. In the third a despatch was sent openly, and the answer received secretly, to show that the secret apparatus might be used or suspended at will. The results of the inquiry are said to show—first, that the apparatus of Tremeschini may be applied to Morse's telegraph; secondly, that when the despatch is sent secretly it can only be received so, any fraud in that respect being subject to immediate detection; thirdly, that secresy may be suspended or applied at pleasure.

The Royal Observatory at Brussels has just been placed in electric communication with the Royal Observatory, Greenwich, for the purpose of facilitating the determination in a direct manner of the difference of longitude between the two establishments. This operation is one of extreme delicacy, as well as of great importance to geodesy. The electric communication is made in such a manner that every oscillation of the pendulum at Brussels will be represented with accuracy at Greenwich, and *vice versa*. The observations are to commence this week.

Public Health—Lead, Copper or Zinc Pipes.—The Minister of Commerce, Agriculture, and Public Works in France, has just issued a circular to all Préfects calling upon them to put a stop to the use of lead pipes in Breweries. The Minister in his circular states that "Experience proves that beer, by simple contact with lead, takes up an appreciable quantity of the metal, and thus acquires poisonous properties, Leaden pipes are not only used in breweries; but a custom has arisen in taverns, and in houses where wine is sold, of using a small pump, which communicates with the barrels in the cellar by means of a leaden pipe. The use of the pipe in this instance is peculiarly objectionable, inasmuch as the action of the pump is at intervals only. A whole family was poisoned by using for some time a pump of this kind for drawing up their odinary consumption of wine. The Préfet of the North, who had already taken the initiative in adopting measures necessary for putting a stop to the methods used in his department for the refining of beer, has, following the advice of the Council of Public Health, just prescribed the use of lead, copper, or zinc pipes for the drawing or transmission of this liquid."

Preparation of Valerianic Acid from Fusel Oil.—Gruneberg recommends the following proportions as the most advantageous, 2¾ lbs. of bichromate of potash are to be introduced into a retort, and 4½ lbs. of hot water poured upon the salt. A cooled mixture of 1 lb. of fusel oil and 4 lbs. of sulphuric acid diluted with 2 lbs. of water is to be allowed to flow very slowly and in a thin stream into the liquid in the retort, and the whole is then to be distilled. The distillation goes on quietly, and 9 ounces of oily valerianic acid are obtained.—*Journal sur prakt. Chemie*, lx, 169.

Photography on Textile Fabrics.—Messrs. Wulff, of Paris, have placed before the French Institute some specimens of photography on linen, oil cloth, chintz., &c. This discovery will be of great importance for architectural ornamentation and other useful purposes. Such pictures can be cleaned by wiping, nay, they can be washed, and a portrait on linen or long-cloth can be forwarded in a letter. As moreover, these photographs can be obtained at a cheaper rate than those on metal or paper, the art will become more popularized. Messrs. Wulff keep their procedure yet secret, but it is thought that they operate on a preparation of idodized collodion.—*Builder*,

Preparation of Ferrocyanhydric Acid.—Liebig gives the following simple method of preparing this acid. When a saturated solution of ferrocyanate of pottash is mixed with its own volume of fuming muriatic acid added in small portions at a time, a snow-white precipitate of pure ferrocyanhydric acid is thrown down. These are to be washed with muriatic acid, dried upon a brick, and dissolved in alcohol; from the alcoholic solution the acid may be obtained in beautiful crystals.—*Ann. der Chimie und Pharmacie*, lxxxvii. 127.

A New Comet.—On the morning of the 2nd December, a comet was discovered by Mr. Klinkerfues, of the Gottingen Observatory, on the border of the Constellation Perseus, near the foot of Andromeda. At four o'clock. a. m., on the 3rd, its right ascension was in 1h. 37m. 20s. and its declination 51 deg. 37 sec. north. The diurnal motion in right ascension was 2m. towards the west, and in declination of 1¼ deg. towards the south. Mr. Klinkerfues was the discover of the third comet of the present year, which became so conspicious at the end of August in the north-western heavens.

Separation of Nickel from Cobalt.—Liebeg has found that when a current of chlorine is passed into a cold solution of the double cyanades of cobalt and potassium and of nickel and potassium, the liquid being kept alkaline by the addition of caustic soda or potash, the nickel is completely converted into sesquioxid and precipitated, while the cobalt remains in solution as unaltered double cyanid. The sesquioxyd of nickel may be washed and the nickel weighed in the form of protoxyd; it is perfectly free from cobalt. The solution after passing the chlorine must still be alkaline. The smallest trace of Nickel gives an inky black color when dissolved in cyanid of potassium, and treated with chlorine. This method of separating cobalt and nickel has perhaps some advantages over Liebig's second method which it will be remembered, consists in boiling the mixed double cyanids with oxyd of mercury, which precipitates the nickel but not the cobalt.

Fossil Human Skulls—Wonderful if True.—The German Association for the Advancement of Science, lately held at Tubingen, appears to have been a most successful gathering. In the course of the proceedings, Prof. Karnat announced that Germany had coal enough to supply herself, and all the rest of the world, for the next 500 years. This is important if true; but the great fact elicited at the meeting was the clearing up of the mystery of the fossil human teeth exhibited at the preceeding year's meeting, which were found, it will be recollected, in the Swabian Alps, in strata of the mammoth period, and doubts expressed as to their being human teeth, as a man was not believed to have existed in the time of the mammoth. Since the meeting in 1852, however, a number of perfect human skulls have been found in the same locality with the teeth in them, which discovery if correctly reported, would naturally lead to the conclusion that a race of human beings was in existence contemporaneously with the mastodon, and other of the larger antediluvian animals.—*Mining Journal.*

The Nova Zembla Bottles.—Colonel Sabine on the part of the Committee of the Royal Society appointed to inquire into the probable origin of some bottles recently found on the shores of Nova Zembla, reported:—

"That the Committee had availed itself of the assistance of the Committee for managing the affairs of Lloyds, and had received from Captain Halsted a report, which is subjoined: and that the Committee have further requested that the Agents for Lloyds on the coast of Norway may be directed to obtain specimens of the bottles stated to be employed by the Norwegian fishermen, to compare with the bottles received from the Admiralty. The evidence relating to the bottle exhibited in the Vestibule of Lloyds, appeared to prove conclusively that it was of Norwegian make and similar to those used by the Norwegian fishermen for the past five years as floats for fishing nets.

Miscellaneous Intelligence.

King's College, London.—The following appointments have been made by the Council of King's College, London, consequent on the vacancy in the List of Professors created by the removal of the Rev. F. D. Maurice. The Rev. Dr. M'Caul is elected into the Chair of Ecclesiastical History,—in addition to that of History and the Old

Testament hitherto held by him. A lecturer is to be appointed to relieve Dr. M'Caul by instructing the junior classes in Hebrew. The Chair of English Literature and Modern History is filled by the nomination of Mr. G. W. Dasent, of Magdalen Hall, Oxford, Doctor of Civil Law.

ACADEMY OF SCIENCES, PARIS.—M. Elie de Beaumont has been elected Secretary of the Paris Academy of Sciences, in the room of the late M. Arago. M. Dupin contested the place with M. de Beaumount. The number of votes were—M. Beaumont, 29; M. Dupin, 17. It is understood that M. Leverrier is to be appointed Keeper of the Observatory.

THE GREATEST ANCIENT AND MODERN SHIPS.—At the Institution of Civil Engineers a paper was read on ocean steamers, in which was the following statement:—

	Tonnage,	External bulk.
Ptolomaeus Philopater's ship....	6,445 tons.	830,700 cubic ft.
Noah's Ark.....	11,705 "	1,580,000 "

Contrasting with these a few modern ships, it was found that

Great Western......................	1,242 tons,......	161,100 cubic ft.
Great Britain	3,445 "	446,570 "
Arctic (American packet).........	2,745 "	356,833 "
Himalaya..............................	3,528 "	457,332 "

and, calculating by the same rules, taking the dimensions given in the prospectus of the Eastern Steam navigation Company, their

Proposed iron ship	22,942 tons ...	2,973,598 cubic ft.

Thus the new ship is just double the size of Noah's Ark.

The *Persia*, to be built by Mr. Robert Napier, of Glasgow, for the Cunard Company, to ply between Liverpool and New York, will be about 45 ft. broad in the beam, and extend in length to 360 ft.; and the tonnage will be 3060. The engines will be 100-in. cylinders, with a 10 ft. stroke. Although no part of this immense vessel has yet been set up, the framework is in rapid progress; and it is believed that she will be ready in twelve months hence;

A REAL GOLD MINE IN ENGLAND.—At last the mining world of London has been electrified by the astounding news that the copper mine in Cornwall, called by the name of Tremollett Down, is nothing less than a *veritable mine of gold*, the mundic, of which the supply is said to be inexhaustible, having yielded to two separate tests the enormous result of *eight ounces of pure gold* per ton, thus placing this now celebrated mine deservedly at the head of all the mines in Europe in point of profit! It is understood that the fortunate shareholders are to have a meeting immediately, to subscribe for two of Berdan's machines, with four basins each, and a steam engine, capable of raising and reducing 100 tons per month, which, at 8 ozs. per ton of gold, makes the Tremollet mundic worth 80*l.* per ton, or, at 1000 tons per month, 80,000*l.*; whilst the cost of raising and reducing this auriferous pyrites will not exceed, royalty included, 5000*l.*, leaving a nett profit of 25,000*l.* per month, or 300,000*l.* per annum, which would make each share worth 400*l.*

FORSTER'S WROUGHT IRON PLATES.—The *Gateshead Observer* has the following remarks on these extraordinary plates:—"Wonders never cease. We have on several occasions noticed the extraordinary productions of the Derwent Iron Works, at Consett—to wit, a rail which quite eclipsed the sea serpent, and plates of a ton weight, of vast breadth and length, for which a prize medal was awarded by the Commissioners of the Great Exhibition, and other things equally extraordinary. But now Mr. Forster the Manager at these works, has outshone himself, and produced what really seems incredible—four wrought-iron plates, 1½ in. thick, 5 ft. broad, and no less than 17 ft. 3 in. long! Think of such plates, as long as a good comfortable room, and weighing no less than 1 to 14 cwts. each! How men can lift such things at all, to say nothing of doing so when they are at an intense white heat, is what we cannot comprehend. And how they are sheared, too. Think of a pair of neat scissors quietly clipping the edges of such plates, 1½ in. thick! If this does not "whip creation" we do not know what does. These large monsters have gone to Glasgow, to astonish the natives there, and are to be used as engine-beams, being much lighter and stronger than cast-iron ones.

CONSUMPTION OF ATMOSPHERIC AIR.—The total produce of pig-iron for the year 1850, was estimated at 2,380,000 tons. In order to produce this quantity there were consumed 9,500,000 tons of coal 2,500,000 tons of ironstone, and the ores operated upon could not have been less than 7,000,000 tons. But the most remarkable fact in connection with the iron trade is the immense weight of atmospheric air required in the various blast furnaces, and which although generally considered as so light in its nature, has yet considerably exceeded in weight that of all other materials consumed. One of the large furnaces of South Wales consumes 12,508 cubic feet of air each minute in supplying the oxygen necessary to the combustion of the fuel. To supply the air consumed on an average in each furnace requires an engine of 25-horse power. Engines of nearly 12,000 horse power are constantly employed to drive the "breath of life" into the glowing masses within the furnaces of the United Kingdom. Each furnace on an average sucks in 17,000 gallons of air per minute, or five tons weight per hour. The number of furnaces in blast in 1850 was 459; the aggregate weight of air, therefore, required during that period to keep life in these fiery monsters was not less than 55,080 tons daily, or 20,049,000 tons during the year—a quantity exceeding in weight the totals of the coals, ore, and limestone consumed in the process of smelting.

MILEAGE OF RAILWAYS.—The mileage of railways in England is 5288 miles 5 furlongs 211 yards; and in Wales 348 miles 5 furlongs 203 yards. Mileage of the railways in the United States 14,064.25.

NOVEL APPLICATION OF GLASS.—The Prussians have put glass to a novel use. A column, consisting entirely of glass, placed on a pedestal of Carrara marble and surmounted by a statute of Peace six feet high, by the celebrated sculptor Ranch, is about to be erected in the garden of the palace of Potsdam. The shaft will be ornamented with spiral lines of blue and white.

Institut Canadien.

The ninth Annual Meeting of the *Institute canadien* was held last week, and gathered the *elite* of the French Canadians of Montreal. We see with pleasure by this report that this society is constantly progressing and promises to be one of the most useful and important institutions of our country. Our readers will be ready to endorse our opinion when they hear that during the year 43 meetings were held, 17 questions discussed and 6 lectures delivered; that its library had an increase 730 volumes, making the present number 2,701; that 66 newspapers were received in the reading room; that its membership has increased to 499; that its receipts have exceeded by £54 11s. 6d. its expenses. A society exhibiting such signs of life and prosperity cannot fail of exerting a powerful and beneficial influence upon the community.

We will only add that the *Institut Canadien* has been incorporated, and it is proposed to adopt measures to secure a building lot and erect a suitable edifice for its use.—*Le Semeur Canadien.*

Canadian Canals.

November Traffic.

	1852.			1853.		
Welland Canal............................	7,579	1	6	8,237	7	4
St. Lawrence.............................	3,172	13	5	2,954	7	10
Chambly..................................	197	9	4	137	19	8
St. Ann's Lock..........................	117	1	0	131	8	8
Burlington Bay Canal............................	819	0	6	906	11	1
	11,885	5	9	12,367	14	7
Previously this year..................	70,954	2	2	81,496	15	5
Total	72,889	7	11	93,864	10	0

Grand Total of Tonnage of Vessels passing through all the Canals.

	1852.	1853.
Nov.	270,544	255,811
Previously this year..................	1,746,937	1940,265
	2,017,481	2,196,076

Grand Total of Merchandize passing through all the Canals.

	1852.	1853.
Nov.	203,354	210,706
Previously this year..................	1.246,221¼	1,497,484½
Total..	1,449,575¼	1,708,190½

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—December, 1853.

Latitude, 43 *deg.* 39.4 *min. North.* *Longitude,* 79 *deg.* 21. *min. West.* *Elevation above Lake Ontario,* 108 *feet.*

Magnet.	Day.	Barom. at tem. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Tem. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y in Miles	Rain in Inch.	Snow in Inch.
						°	°	°	°														
a	1	29.760	29.741	29.683	29.729	30.5	29-8	29.4	29.83	0.155	0.118	0.127	0.128	91	70	78	75	N b E	N N E	NE b N	5.57	...	Inap.
b	2	.624	.593	.634	.616	26.0	28.5	29.8	28.02	.122	.122	.122	.124	86	77	78	80	N E	NE b N	N b W	5.49	...	...
b	3	.584	.768	.902	.767	31.8	29.5	22.0	26.97	.148	.113	-096	.117	82	70	79	77	NW b N	N W	N b W	8.96	...	...
c	4	.945	.909	—	—	19.0	28.4	—	—	.095	.134	—	—	89	84	—	—	NW b W	W S W	—	1.65	...	2.3
e	5	.762	.752	.738	.744	26.8	34.8	32.5	29.88	.125	.169	.168	.146	86	84	92	87	Calm	Calm	W b N	0-99	0.450	...
e	6	.424	.326	.697	.480	35.9	40.6	33.8	36.67	.180	.208	.153	.178	86	81	78	82	S b E	W b S	N W	9.80	0.015	Inap.
a	7	.880	.952	.984	.944	27.4	25.1	20.0	28.65	.140	.110	.094	.108	93	79	84	82	N b W	N b W	Calm	4.97	...	...
a	8	.938	.817	.744	.827	23.0	33.0	29.1	28.53	.109	.131	.141	.128	85	70	88	81	Calm	S W	SW b W	3.94	...	...
b	9	.737	.650	.664	.685	20.2	39.5	30.9	29.82	.095	.190	.130	.135	85	79	75	78	Calm	SW b W	Calm	2.08	...	...
a	10	.650	.612	.537	.688	25.5	41.6	32.8	32.95	.116	.183	.144	.149	81	70	79	79	Calm	S W	Calm	1.80	...	...
a	11	.650	.669	—	—	27.1	42.2	—	—	.123	.158	—	—	82	57	—	—	S W	S S W	—	1.98	...	...
af	12	.766	.708	.766	.750	34.8	39.5	37.2	37.00	.176	.206	.196	.192	88	86	89	88	NE b E	Calm	N b E	1.88	...	...
b	13	.862	.864	.877	.868	35.9	39.1	28.7	34.03	.169	.194	.137	.164	81	82	87	83	N E	N N E	Calm	0,95	...	...
b	14	.800	.749	.762	.769	32.3	35.9	34.5	34.13	.162	.164	.171	.166	89	78	86	84	Calm	W b S	Calm	1.80	...	...
c	15	.721	.669	.614	.667	34.3	35.3	33.8	34.38	.170	.170	.166	.170	87	88	86	86	Calm	W b N	Calm	1.42	Inap.	...
c	16	.533	.454	.384	.434	36.8	38.3	33.4	36.13	.200	.198	.174	.192	92	86	92	90	Calm	W b S	Calm	0.72	0.050	0.3
b	17	.300	.137	28.969	.126	33.2	34.6	21.9	29.25	.180	.171	.091	.145	95	86	75	87	Calm	NE b N	N	11.01	...	0.3
c	18	.096	.288	—	—	15.8	16.3	—	—	.078	.065	—	—	83	68	—	—	N N W	N N W	—	9.13	...	0.1
—	19	.531	.583	29.701	.617	9.0	15.4	4.9	9.73	.064	.069	.045	.060	93	75	77	83	N E	N b E	N b E	2.93	...	0.3
c	20	.777	.838	.948	.866	10.8	21.9	19.0	16.70	.051	.078	.081	.070	67	65	76	71	N b E	W b N	W b S	3.92	...	...
d	21	.937	.833	.696	.801	19.4	21.8	24.1	21.72	.087	.090	.115	.099	80	76	86	81	W	Calm	SW b S	2,35	...	0.4
c	22	.618	,616	.461	.549	28.7	33.2	33.2	31.83	.129	.185	.173	.148	80	71	92	82	W S W	SW b W	S S E	2.64	0.110	0.1
c	23	.083	.154	.508	.265	33.8	27.1	17.6	25.20	.180	.104	.080	.114	94	69	79	79	W b S	W b N	NW b W	13.32	...	Inap.
b	24	.608	.447	.458	.504	17.2	28.6	14.2	17.97	,081	.097	.076	.084	81	74	86	81	W S W	W S W	W b S	8.54	...	...
b	25	.501	.474	.—	—	30.2	32.5	—	—	.150	.141	—	—	89	77	—	—	W	W S W	—	6.82	...	2.8
a	26	28.973	29.061	—	—	29.8	30.6	—	—	.154	.147	—	—	94	86	—	—	S S E	N N W	—	7.64	...	Inap.
a	27	29,520	.506	.485	.503	19.4	22.3	25.8	22.22	.092	.106	.118	.100	84	86	83	80	N b E	N N E	N E	6.07	...	3.0
d	28	.459	.498	.500	.483	14.4	10.6	7.1	8.68	.074	.057	.051	056	83	77	77	80	N E	NE b N	N N E	8.99	...	0.5
b	29	.529	.496	.411	.474	-3.9	7.1	2.9	2.43	.024	.044	.048	.036	62	66	70	61	N	N b W	NW b N	4.83	...	2.3
b	30	.293	,084	.100	.159	8.0	18.0	14.4	13.47	.053	.088	.078	.074	79	85	89	85	N E	E N E	NE b N	8.43	...	6.5
b	31	.201	.238	.424	.298	5.7	27.3	16.5	17.72	.042	.136	.087	.093	70	90	90	84	N N E	Calm	W	4.32	...	3.4
—	M	29.611	29.580	29.605	29.5984	23.71	28.94	24.19	25.32	0.120	0.182	0.118	0.122	84	78	82	81	3.84	6.10	4.50	4.98	0.625	22.3

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1876.38.	1690.09.	460.62.	585.70.

Mean direction of Wind N W b N.

Mean velocity of the Wind... 4.98 miles per hour.

Maximum velocity .... 25.0 miles per hour, from 9 to 10 p.m. on 17th.

Most windy day...... 23rd; Mean velocity... 13.32 miles per hour.

Least windy day ..... 16th; Mean velocity... 0.72 ditto.

Raining on 4 days. Raining 11.0 hours.

Snowing on 18 days. Snowing 60.8 hours.

Toronto Bay frozen over on the morning of the 19th.

First Sleighing in Toronto on the 16th.

Toronto Bay crossed on foot on the 21st, going and returning from Toronto to the Peninsula.

Highest Barometer...... 29.984, at 10 p.m. on 7th } Monthly range:
Lowest Barometer ...... 28.952, at midnight, 17th } 1.032 inches.

Highest temperature.... 46.4, at p.m. on 11th } Monthly range:
Lowest temperature ... —8°.4. at a.m. on 29th } 54°.8.

Mean Maximum Thermometer ...... 31.32 }
Mean Minimum Thermometer ...... 17.18 } Mean daily range, 14.14.

Greatest daily range .... 24.9, from p.m. 27th to a.m. of 28th.

Warmest day...... 12th. Mean temperature ...... 37.00 } Difference
Coldest day......... 29th. Mean temperature ...... 2.43 } 34°.57.

Aurora observed on 5 nights. Possible to see Aurora on 8 nights. Impossible to see Aurora, 18 nights.

Comparative Table for December.

Year.	Temperature. Mean.	Max. obs'vd.	Min. obs'vd.	Range.	Rain. D's.	Inch.	Snow. D'ys	Inch.	Wind Mean Vel'y.	
	°	°	°	°						
1840	24.8	41.0	—4.4	45.4	8	0.000	18	Not Record'd.	Not Record'd.	
1841	28.7	45.5	+2.4	43.1	7	6.600	5			
1842	24.7	40.3	+3.8	36.5	3	0.880	17			
1843	30.0	41.1	+2.7	38.4	6	1.040	8	8.1	0.58	lb.
1844	28.2	48.9	—0.8	49.7	6	imp.	6	4.2	0.40	lb.
1845	21.1	37.6	—2.7	40.3	2	0.000	12	4.7	0.70	lb.
1846	27,5	49.2	+3.7	45.5	5	1,215	9	6.0	0.57	lb.
1847	30.1	50.0	+6.6	43.4	7	1,185	8	6.8	4.55	Miles.
1848	29.1	49.1	+0.6	48.5	7	2.750	7	16.5	5.44	Miles.
1849	26.5	41.3	—5.2	46.5	5	0.840	12	9.6	6.23	Miles.
1850	21.7	48.3	—9.7	58.0	2	0.190	18	29.5	7.40	Miles.
1851	21.5	43.8	—10.5	54.3	6	1.075	15	10.7	7.87	Miles.
1852	31.9	41.0	+13.9	27.1	7	3.995	10	20.1	6.54	Miles.
1853	25.3	42.2	—5.2	47.4	4	0.625	13	22.3	4.98	Miles.
									0.55	lb.
M'n.	26.47	44.24	—0.34	44.58	5'0	1.569	11.3	12.59	6.07	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—December, 1853.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 *deg.* 32 *min. North. Longitude*—73 *deg.* 36 *min. West. Height above the Level of the Sea*—118 *Feet.*

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6. A.M.	2 P.M.	10 P.M.	6 P.M.	2 P.M.	10. A.M.	6 P.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			6 A.M.	2 P.M.	19 P.M.
1	29.654	29.582	29.597	21.2	26.0	19.0	.086	.108	.080	.64	.64	.64	N E	N E	N E	9.58	8.52	3.62			Clear.	Clear.	Clear.
2	.601	.532	.536	15.0	23.0	20.0	072	082	064	63	57	56	N E	N E	N E b E	10.11	6.08	5.15			Do.	Do.	Overcast.
3	.490	.387	.565	30.1	23.1	17.0	125	106	069	67	73	60	N E b E	N N E	N W	7.08	5.80	6.50		0.92	Overcast.	Slight Snow.	Clear. [lis.
4	.740	.710	.754	3.0	11.8	2.5	044	063	033	77	67	57	W N W	W N W	W b S	10.66	7.78	4.27			Clear.	Clear.	Do. A. Borea-
5	.750	.687	.696	0.0	12.5	14.5	025	070	066	50	73	64	N E b N	N E b E	N E b E	0.50	4.00	5.42			Cir. Str. 10.	Cir. Str. 9.	Cir. Str. 10.
6	.442	.098	.236	22.0	32.5	27.5	079	160	112	63	80	67	N E b E	E S E	W N W	5.60	5.02	7.72		1.00	Cir. Str. 10.	Snowwith hail	Clear.
7	.590	.642	.712	18.5	19.6	16.5	082	178	074	68	60	64	W N W	W b N	W b N	1.90	9.30	7.49			Str. 2.	Str. 10.	Str. 10.
8	.668	.596	.541	18.5	28.8	28.0	064	129	119	63	72	68	W	W S W	S W b W	9.00	6.87	8.12			Do. 10.	Cum. Str. 10.	Do. 10.
9	.517	.495	.461	30.0	41.0	30.0	138	253	145	74	72	78	W S W	S W	S W	8.00	6.42	5.00			Cir. Str. 10.	Do. 2.	Clear.
10	.492	.455	.506	22-5	34.0	26.0	096	170	118	68	79	73	S W	W N W	N W b N	3.40	0.37	0.80			Do. do 10.	Clear.	Fog.
11	,518	.497	.568	28.0	32.2	29.5	153	182	152	88	91	85	W N W	W	W N W	0.08	0.94	3.03			Fog.	Str. 5.	Hazy.
12	.606	.511	.538	31.0	36.0	31.0	171	192	141	89	83	72	W N W	E	N W b W	0.62	0.02	2,52			Str. 10.	Do. 10.	Str. 10.
13	.621	.628	.692	29.0	39.3	23.0	157	214	099	76	84	69	W N W	E b N	E b N	1.75	3.44	1.75			Clear.	Clear.	Clear.
14	.651	.584	.516	11.5	33.0	30.5	067	197	168	67	95	90	N E b E	N b E	S W	0.23	0.09	0.52			Do.	Do.	Str.10.
15	.531	.497	.456	25.0	37.0	32.9	185	218	197	86	91	95	W	W S W	W S W	0.32	0.16	0.16			Do.	Str. 10.	Do. 10.
16	.389	.383	.238	33.5	36.0	34.0	199	210	204	95	91	95	S S W	S W b S	S	1.80	3.30	3.95			Str. 10.	Do. 10.	Do. Rain at 10
17	.167	28.994	.011	33.2	36.0	24.1	197	220	135	95	94	90	S	S	N E b E	0.11	1.24	13.32	0.816		Slight Rain.	Do. 10.	Sleet. [40p.m.
18	28.848	28.847	.164	22.0	14.0	4.2	123	075	056	88	72	95	N W	W N W	W	18.00	10.73	7.97		6.50	Snow.	Cir. Str. 5.	Str. 10.
19	29.400	29.468	.585	–7.8	2.6	–10.2	033	046	019	91	84	60	W b N	W b N	W b N	14.51	0.75	0.16			Str. 10.	Clear.	Clear. [lis.
20	.641	.719	.754	–21.5	2.1	–12.5	013	042	019	63	76	63	W b N	W b N	W N W	Calm	Calm	0.16			Clear.	Ditto.	Do. A. Borea-
21	.798	.789	.700	–0.5	7.5	5.7	027	055	062	68	80	82	N N E	N E b E	N E b E	0.22	0.03	Calm			Str. 10.	Str. 10.	Str. 10.
22	.599	.548	.545	–7.2	16.5	18.0	054	086	094	79	85	85	N E b E	N E b E	N E	5.00	0.21	Calm		Inapp	Do. 10.	Slight Snow.	Do. 10.
23	.147	28.851	28.950	26.0	35.0	26.0	182	203	185	88	91	88	E b S	S	W N W	3.32	12.13	6.22		3.40	Do. 10.	Str. 8.	Clear.
24	.150	29.221	29.422	25-0	6.3	8.5	123	043	058	79	63	80	W N W	W b N	W b N	22.00	26.25	19.59			Do. 10.	Cir. Str. 5.	Str. 10.
25	.265	.260	.258	10.0	19.5	17.2	065	097	096	72	77	83	W b N	W b N	W S W	17.63	2.05	2.95			Do. 10.	Str. 10.	Clear.
26	.105	.100	.101	16.1	21.0	19.0	105	111	097	94	83	77	N E b E	N E b E	N E b E	2.30	12.14	14.47		0.60	Do. 10.	Snow.	Snow.
27	.279	.280	.282	14.1	18.5	0.0	080	088	044	78	87	83	N W	W N W	W b N	26.51	12.20	10,05		0.11	Do. 10.	Str. 8.	Clear. [lis.
28	.286	.329	.335	–8.0	8.0	–0.9	026	036	015	79	59	88	W b S	W	W	8.13	1.15	0.03			Do. 8.	Clear.	Do. A. Borea-
29	.108	.251	.100	–13.1	–0.2	–3.9	019	036	032	63	84	70	N	N W	W N W	Calm	Calm	8.51			Do. 10.	Do.	Do.
30	.166	.277	.266	–12.1	0.4	1.5	017	051	044	57	85	84	W S W	W SW	N E b E	4.54	6.47	Calm			Clear.	Str. 8.	Snow.
31	.284	.270	.351	2.1	13.0	4.9	043	088	047	77	87	78	N E b E	N E b E	N E b E	5.24	1.12	0 50		0.60	Str. 10.	Do. 10.	Clear.

Barometer	Highest, the 21st day	29.798
	Lowest, the 18th day	28.848
	Monthly Mean	29.456
	,, Range	0.950
Thermometer.	Highest, the 9th day	41°.0
	Lowest, the 20th day	–21°.5
	Monthly Mean	16°.56
	,, Range	62°.5
Greatest Intensity of the Sun's Rays		131°.0
Mean Humidity		.759

Rain fell in 1 day amounting to 0.816 inches.
Snow fell on 7 days amounting to 13.13 inches.
Winter fairly set in 18th December.
Most prevalent Wind N E b E.
Least do. do. E.
Most Windy Day, the 24th day; Mean miles per hour, 22 61.
Least Windy Day, the 20th day; Mean miles per hour, 0.05.
The Electrical State of the Atmosphere has been marked *generally* by a Moderate Intensity of Positive Electricity; and during the Snow Storms of the 3rd and 6th days indicated a High Tension of a *positive* character.

Monthly Meteorological Register, Quebec, Canada East.—December, 1853.

BY LIEUT. A. NOBLE, R.A.

Latitude, 46 *deg.* 49.2 *min.; Longitude,* 71 *deg.* 16 *min. Elevation above the level of the Sea, — Feet.*

Date.	Barometer corrected and reduced to 32 degree, Fahr.				Temperature of Air.				Elasticity of Air.				Humidity of Air.				Direction of Wind.			Velocity of Air.			Rain in inch.	Snow in inch.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	6 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.		
					°	°	°	°																
1	29.950	29.914	29.910	29.925	23.0	23.2	24.0	23.4	.111	.093	.129	.111	.87	.73	.95	.85	N E	E N E	E N E	15.2	11.4	8.	...	...
2	.903	.919	.863	.895	20.5	20.0	19.0	19.8	096	090	092	093	85	80	87	84	N E	N E	E N E	13.9	13.4	14.3	...	...
3	.767	.702	.740	.736	20.0	23.4	18.0	20.4	082	120	092	098	90	93	81	88	E b N	E N E	E	11.4	10.9	6.2	...	3.0
4	.879	.944	30.040	.954	4.4	9.0	2.5	5.3	047	051	040	046	81	73	75	76	N N W	N W	N W	10.9	8.8	8.	...	...
5	30.054	30.057	.055	30.055	3.3	12.0	13 0	9.4	041	053	064	053	76	66	76	73	N W	Calm	Calm	8.	...	...	...	1.0
6	29.929	29.608	29.349	29.627	20.4	24.5	26.0	23.6	092	119	136	116	81	88	96	88	E	E b S	E b S	10.1	11.4	10.1	...	5.0
7	.474	.814	.805	29.698	21.5	25.1	17.0	21.2	112	106	075	098	94	77	77	83	Calm	N N W	N N W	...	8.8	8.	...	...
8	.930	.868	.849	.882	16.8	23.5	21.6	21.0	089	108	117	105	91	83	97	90	N N W	N N W	Calm	6.2	3.8	...	...	2.5
9	.734	.789	.748	.757	27.0	35.0	1.5	31.1	125	156	153	145	84	77	87	83	W	W b S	W b S	5.2	3.8	3.8	...	...
10	.755	.766	.766	.762	32.5	37 5	33.3	34.4	166	180	175	174	91	80	93	88	N N W	W N W	W N W	3.8	3.8	3.8	...	...
11	.793	.805	.862	.820	30.8	32.8	39.6	31.1	159	163	144	155	93	88	88	90	N W	N W	Calm	3.8	3.8	...	...	...
12	.874	.853	.857	.861	26.5	35.6	31.7	31.3	140	162	158	153	96	78	89	.88	Calm	Calm	E	...	...	8.	...	...
13	.855	.974	30.046	.958	30.2	32.0	17.0	26.4	162	171	091	141	96	95	92	94	Calm	E b N	Calm	...	5.2	...	...	...
14	30.006	.850	29.762	.873	10.3	24.8	24.3	19.8	051	116	113	093	69	85	84	79	Calm	N W	N W	...	5.2	8.	...	...
15	29.760	.817	.770	.782	25.5	33.0	30.2	29.6	121	156	146	141	84	83	88	85	N N W	N N W	W N W	6.2	5.2	3.8	...	...
16	.703	.648	.573	.641	30.5	35.2	36.3	34.0	135	178	155	156	79	87	73	80	Calm	W b N	W b N	...	3.8	3.8	...	1.5
17	.494	.422	.341	.419	33.3	38.5	29.0	33.6	183	198	144	175	97	85	90	91	Calm	E b N	E b N	...	6.2	19.	...	3.5
18	28.893	28.844	.127	28.934	27.5	24.2	11.5	21.1	137	112	058	102	90	84	75	83	E N E	Var.	N W	19.7	11.4	13.9	...	0.5
19	29.451	29.689	.650	29.597	–2.5	0.4	–6.5	–2.9	029	044	027	033	67	90	76	78	N W	N W	N W	8.0	8.	3.8	...	...
20	.857	.991	30.048	.965	–17.8	–4.8	–8.0	–10.2	012	031	027	023	59	86	84	76	N W	N W	N W	3.8	3.8	3.8	...	...
21	30.078	30.095	30.056	30.077	–3.0	7.8	5.0	3.2	026	053	047	042	63	79	79	74	N N W	N N W	N N W	5.2	5.2	3.8	...	...
22	29.994	29.917	29.882	29.931	10.3	15.8	18.0	14.7	059	082	089	077	80	87	87	85	E	E	E b N	5.2	13.4	8.	...	1.5
23	.648	.266	.102	.339	20.8	22.9	27.5	23.7	114	119	132	122	97	94	87	93	E N E	E N E	E N E	10.1	11.4	6.2	...	9.5
24	.044	.104	.106	.084	24.5	13.5	3.5	13.8	109	071	041	074	81	82	74	79	N N W	N W	N N W	9.3	8.	8.	...	...
25	.284	.404	.498	.395	4.3	15.8	15.5	12.2	048	087	088	074	83	93	95	90	N W	N W	N W	9.3	7.2	8.	...	...
26	.454	.355	.369	.393	10.5	20.5	21.0	17.3	095	096	103	098	68	85	88	80	E N E	E N E	E N E	9.3	11.4	10.9	...	1.5
27	.421	.386	.346	.384	22.5	23.1	11.5	19.0	108	122	063	098	96	96	79	90	N b W	N b W	N N W	9.3	8.8	13.9	...	1.8
28	.331	.524	.611	.488	4.5	5.2	–2.5	2.4	045	058	021	041	77	95	48	73	W N W	N N W	N N W	13.9	10.9	7.2	...	...
29	.522	.822	.082	.309	–8.0	3.2	2.0	–0.9	029	047	040	039	88	84	77	83	Calm	N N W	N N W	...	8.8	10.9	...	3.0
30	.197	.449	.580	.408	–3.5	6.0	1.0	1.2	029	043	045	039	71	70	90	77	N W	N W	N W	10.1	8.	6.2	...	1.0
31	.492	.530	.785	.585	9.8	14.2	13-5	12.5	062	085	068	072	85	96	79	87	N W	E S E	E S E	6.2	6.2	6.2	...	2.0
	29.660	29.665	29.660	29.662	15.3	20.4	16.8	17.5	091	105	093	096	83	84	83	84				6.9	7.3	6.9	0.0	37.3

REMARKS

1st. At about 11½ a.m. light cirrus clouds at a great elevation; at L s. to the meridian. Aurora visible.

2nd. A very faint Aurora.

3rd. Snowing from 12¼ to 7¼ p.m. Aurora visible.

4th. A good Aurora appeared at 6, still visible at 11.

6th. Snowed 1½ p.m. to 10½ p.m.

7th. A very faint Aurora.

8th. Snowed from 5½ a.m. to 2 p.m.

12th. Aurora visible at 6 a.m., not visible previously.

13th. cirrus clouds L s. to meridian at 2 p.m.

14th. Lunar halo 60° in diameter at 6 o'clock p.m.

15th. At 1 p.m. cirrus clouds at Ls. to meridian.

22nd. Sky covered with clouds, but in the north a dark arch, and a glow above it; thought it might be Aurora. Observed this about 9 p.m.

26th. Lower stratum of clouds moving; with the wind E.N.E. Upper stratum S.S.E.

Highest Barometer, at 2 p.m. an the 21st............... 30.059 }
Lowest Barometer, at 2 p.m. on the 18th............... 28.844 } Monthly Range, 1.251 in.

Maximum Thermometer, on the 17th .... 88.5 }
Minimum Thermometer, on the 20th .... –18.0 } Monthly Range, 56°.5.

Mean Maximum, Thermometer, ... 22.4 }
Mean Minimum, Thermometer, ... 10.1 } Mean Daily Range, 12°.3.

Greatest Daily Range .... 30°.0 on the 18th.
Least Daily Range .... 8°.5 on the 2d.

Warmest Day, the 10th .... 34°.4 }
Coldest Day, the 20th .... –10.2 } Climatic Difference, 44°.2.

Possible to see Aurora on 11 nights.
Aurora actually visible on 9 nights.

The Canadian Journal.

TORONTO, MARCH, 1854.

Norris's Railway Joint Chair.*

The following paper on Mr. Norris's new joint chair was read at the last meeting of the Institution of Mechanical Engineers at Birmingham:—

In bringing before the Institution a plan for a new kind of joint chair for railways, it will be unnecessary to expatiate on the advantages of a *firm joint*, as regards economy of maintenance of the road and rolling stock, and safety.

The object of this paper is to describe a method which has been in use on a crowded part of the London and North Western Railway for above eighteen months, during which time it has stood well, and is now being extensively used on the same line.

The plan is to cast a chair or coupling on the rails at the joints as they lie in the line, by means of chills and a portable cupola. The hot metal flowing freely into the chill is allowed to come in close contact with the rails, and in cooling contracts so as to grip the ends of the rails firmly together. The great object to be attained is the converting of the rail into a continuous girder, which shall not deflect at the joint more than at any other part; every successive year's experience having forced the attention of engineers and others to this point, to attain which many plans have been tried with more or less success.

Whatever mode of joint is adopted, or whatever method of jointing the ends of rails, it is necessary that a certain allowance should be made for the longitudinal motion caused by the expansion and contraction of the rail. This object is attained, wherever necessary, by putting the chills, previously heated, on the ends of the rails for a short time, until they become hot, when they are taken off, and a thin wash of loam and blacking is laid upon the rail end, which instantly dries on, and when the melted iron is poured against it, absolute contact with the rail is prevented. Although provision is thus made for the expansive and contractile force of the rail, the cavity in the chair being parallel to the rail, clips it sufficiently tight to prevent any vertical or lateral motion of the rails; the amount of surface of contact between the rail and chair is about 100 square inches, being 50 square inches to each rail end.

This great surface prevents any perceptible wear taking place on rail-ends from the longitudinal motion of expansion; and as no motion can take place vertically or laterally, no shock can take place by the action of the wheels, so that the joint will remain good for years, which has been confirmed by practice, so far as it has gone.

The operation of casting is very simple, and is performed without hindering the pacing of trains during the execution of the work.

The apparatus consists of chills and a portable cupola, and the process is as follows, when operating on a line already laid:—Each joint-sleeper or block is first lowered by the plate-layers about three inches, so as to give room for the application of the chills, or is removed altogether for the time, and the old chair being taking off the joint, the chills are applied, consisting of a bed plate with two lips, one on each side, holding down the side-chills, which slide in the grooves; these are put to the rail and held together by screw-clips, forming a mould for casting the chair. This operation is quickly performed, and the chill is then packed under temporarily with loose metal plates: the moment this is done a train may pass over it without hindrance.

Two steel pins are then put in their places in the chills, so as to form the cores for the holes of the holding-down spikes. The chill mould being thus fastened in its place is ready for the melted metal, which is run into it at the lip, until it is level with the top of the sides, where a large open space is left for the escape of air, which prevents all possibility of blowing.

The chills are made to fit the rails by projections at each end, which grip the rail firmly, and a little loam is applied on the outside, to prevent the hot metal making its way out of the chill-mould.

After a lapse of about five minutes the mould is taken off, which is done in an instant, leaving the chair perfect, and closely embracing the contiguous ends of the rail. The form of this chair is such as to make it a strong and rigid clip, closely fitting the two ends of the rail along its whole length. Chairs may by this method be cast of any form. When the chair is cold enough, the sleeper or block is replaced, and the chair spiked to it.

The operation is the same in relaying new roads, only that the expense of lowering or removing the block or sleeper is saved.

The metal used up to the present time has consisted of old chairs, mixed with a little new iron. This is melted in a portable cupola, formed of a cylinder of sheet-iron 1-16th of an inch thick, 2 feet 3 inches in diameter, and 4 feet 6 inches high, lined with fire bricks and clay in the usual manner, 4 inches thick.

The cupola weighs about 6 cwt., and is easily lifted by the workmen on to a plate-layer's lorry, and taken to the place required, when it is lifted off, and placed on a few sleepers laid on the slope of a cutting or embankment. When once so placed it will serve for a half a mile of road without moving again, as the metal is so hot as to enable its being taken, in a moulder's ladle, on a lorry, to the chills at a quarter of a mile on each side the cupola.

The cupola has a belt or air chamber, into which passes the air from the fan, and it has four tuyeres of two inches orifice to admit the air to the fire The fan consists of a chamber 1 foot 10 inches inside in diameter and 9 inches wide, and weighs about 3 cwt.; it is detached from the cupola by drawing out the nozzle from the entrance to the air belt, and can then be lifted separately into its place. The fan is either turned by hand-winches, or, when the operations are extensive, by a small steam-engine, weighing about 10 cwt., and can be lifted by eight men, and placed on and off a lorry, and on the slope, in the same manner as the cupola.

The yield of metal from so small a cupola is very great: as much as 3½ tons has been run down in seven hours, by two men turning the handles of the fan, and nearly 4½ tons by the use of the engine in the same time. A smaller cupola, weighing about 2 cwt., is used for repairs of the line.

A good fastening is made for middle chairs by taking out the wooden key from the common middle chair, and casting an iron

* From the London Mechanics' Magazine, October, 1853.

one in its place. This is done by heaping dry sand around the chair, as it stands in its place, and then running metal into the cavity so formed, leaving a lip projecting over the chair. Only a few of these have yet been put down; but they have stood the test of two years' working over without failure, and are still tight. In casting, the hot metal running into the chair expands it, and its contracting upon the cast key in cooling makes it tight.

It may be remarked, that the new chair occupies exactly the same position on the sleepers, and has the same fixing, as the common joint-chair; so that in case of damage to the line from accident or slips, it can be repaired quickly in the ordinary manner, by using the old chairs and wood keys until the same cupola can be brought to bear.

Mr. Norris exhibited specimens of the chairs and the cast iron mould, complete; also a specimen of one of the new joint-chairs from the North Union Railway, which had been laid down for eighteen months in a line of great traffic, where 500,000 wheels had passed over it during the time; the two rail ends were cut off, and remained fixed fast in the chair, and the surface of the joint was level and smooth, although the rail ends had been much indented at the time the chair was cast on, from the rails having been recently turned.

The Chairman inquired what length of line had been tried with the new chairs and how long they had been at work?

Mr. Norris replied, that five miles had been recently laid with these chairs near Rugby, and about a mile was previously laid near Crewe, and elsewhere, which had mostly been at work one and a half years.

Mr. Woodhouse said, the recent trial of the chairs near Rugby had been made under his superintendence, and he had found the result highly satisfactory. It had been intended to relay that portion of the line during the present summer; but the new joint-chairs had proved of such benefit, that they would probably give several years additional life to that road. He consequently recommended the adoption of the plan on a considerable length at other parts of the line, which was now in progress.

The Chairman asked what difference was felt in the train running over the joints on the portion that had been altered at Rugby?

Mr. Woodhouse said, the joints could not be felt at all with the new chairs; there was no comparison of the ease in traveling over the old plan of joints.

The Chairman asked what was the usual time required for the process of casting the chairs?

Mr. Woodhouse replied, that the average of the work done at Rugby was about one chair cast every four minutes, including the whole process of preparation.

Mr. Slate remarked, it was certainly a very ingenious process of casting the chairs, and must make a thoroughly firm joint; he inquired what was the expense of casting?

Mr. Norris said that the labor of casting cost about 6d. per chair, and the cost was about 1s. per chair, including all expenses except the metal, which weighed about 50 lbs. The expense of casting was much diminished as the men got more experienced in managing it. At first they could only cast 40 chairs per day, but the rapidity of casting increased with practice to 80 per day; and now 120 per day were cast by common plate-layers, who had never before had anything to do with melted iron.

Mr. Slate said he had seen the first of these chairs one and a half years since, and had then an unfavorable opinion of their standing in work from the great contraction of the melted metal in cooling on the rigid rail: but it appeared that the wrought iron rail was expanded by the heat of the melted metal sufficiently to make the chair safe by its contraction again in cooling. He thought the new chair made a very perfect coupling of the rail ends, and was a great improvement on fishings and other plans, which he could only regard as makeshifts; and though they had a very good effect compared with the previous plan of having nothing to couple the rails together at the joints, they were still far removed from perfection. The new chair might be said to be quite perfect, if it could be made quite fast on the rail without allowing it to slide.

Mr. Norris observed, that only every third or fourth joint was made a slip joint for expansion; he was aware what a great advantage it would be to have no slip-joints, and by no means maintained that to be impracticable; the expansion of the rails successively by the heat of casting the chairs on, would perhaps elongate them sufficiently to make provision for the expansion from the highest temperature they would be afterwards exposed to, and the tension would then resist the contraction from cold.

Mr. May remarked, that Mr. Brunel had now many miles' length of Barlow's rail on the South Wales Railway, all rivetted fast together, without any provision for expansion and no difficulty was experienced in consequence. There was some misconception on this point, respecting the action of expansion; it was limited in amount of force, and if opposed by a greater force, no amount of expansion or contraction could take place. Wrought iron raised in temperature 15° was expanded 1-10,000th of its length, and exerted a force of 1 ton per square inch of section by the expansion; consequently, no expansion of the rails would take place if a resistance were opposed of 1 ton per square inch for each 15° rise of temperature. He thought it probable that Mr. Norris's plan ultimately would require to have no expansion joints to perfect it, and in many cases he did not doubt the plan being an excellent one.

Mr. James Nasmyth said he had witnessed the whole process of casting the chairs, and fitting on the iron moulds, and considered it a very successful plan, and of the utmost value and importance to the durability of the line as well as to the safety of the public. The trains ran full speed over the red hot chairs directly after they were cast. He thought the slight tortuosities of all roads, even in the straight parts, would be probably found sufficient to allow for the effect of expansion, without making any provision of slip joints.

Mr. May suggested, that an experiment could readily be tried to ascertain the actual amount of expansion of the rails, by having a number of thin graduated wedges, to be dropped into the joints at the hottest part of the day and at night, to measure the amount of expansion over a considerable length of rail. It would probably be found to be very insignificant, as the ordinary chairs offer a considerable resistance to a longitudinal motion of the rail, by the hold of the keys on the rail, the chairs on the keys, and the ground on the sleepers; though of course the resistance in Barlow's rail was a different case, where the rail, chair, and sleeper were all one.

Mr. Woodhouse remarked, that in laying the rails the men place small wooden or iron packing pieces, 1-16th of an inch thick, between the rail ends at the joints, to make the ordinary allowance for expansion; and they always find that if these pieces are put in early in the day, they become so tight in the

middle of the day that they cannot be got out, but are quite loose in the cool of the evening.

The Chairman observed, there was no doubt the expansive action of the heat would always produce its full effect, either by compressing the iron of the rails, or producing some motion or distortion in their position.

Mr. Norris said, that cases had occurred of the road becoming hog-backed, rising with the sleepers out of the ballast, from the want of sufficient allowance for expansion; also in curves, the rails and sleepers had been pushed bodily outwards in the ballast by the effect of expansion. The extreme change of length in this country, from 80° or 90° variations of temperature, amounted to a yard per mile, and this yard length must be disposed of somewhere in each mile, either by sliding or tension, or else by bending upwards or laterally, if there was not less resistance to compression of the iron.

Mr. C. Cowper remarked, that the extreme change of temperature of 90° would cause a total strain on the iron of 6 tons per square inch, at 1 ton for 15°, which amounted to the very severe total force of 40 or 50 tons on the whole sectional area of the rail of 7 or 8 square inches, to overcome any supposed resistance.

Mr. May thought the change of temperature in the rails would be considerably less than that of the air, because they were partly buried in the ground, and must therefore follow the temperature of the surface of the earth, which fluctuated much less than that of the air.

Mr. Duclos remarked. that the expansion or contraction of the rails would only take place from the mean temperature to the maximum or minimum: and as the mean temperature of the air in this country was about 50°, and the maximum 90°, making a change in the air of 40°, the actual change in the rails from the mean temperature was probably less than 30°, causing a strain of not more than 2 tons per inch expansion or contraction.

The Chairman observed, it was an important subject for consideration, whether the allowance for expansion could be entirely dispensed with; and the new chair appeared an important step in that direction, and might lead to doing away with longitudinal bearings.

Mr. Norris said that his attention had been first directed to the subject of this chair about two years since, by the circumstance of a very extensive alteration having been in contemplation from the ordinary rail and cross sleepers to a bridge rail on longitudinal timbers, the alteration being proposed entirely on the ground of obtaining a superior coupling of the joints with the longitudinal bearing than the ordinary rail and chair. But he objected to the bridge rail and longitudinal timbers as more expensive; and the idea then occurred to him of running the melted metal into the chairs to fill them up solid, and make a rigid coupling of the joint; and this led him to casting the joint-chairs solid upon the rails in their places, as the complete way of carrying out the object.

Preliminary Account and Results of the Expedition of Dr. Richard Lepsius to Egypt, Ethiopia, and the Peninsula of Sinai.*

The fertile and extensive province of Dongola, on the northern frontier, which we traversed on the 4th of June, after our departure from Barkal, afforded us but few remarkable ancient remains; we may, however, mention among these the Island of Argo, with its monuments, from the 13th Manethonic Dynasty. They became still more numerous in the northern borders of Dongola, from which a nearly continuous cataract country extends as far as Wadi Halfa. Near Tombos we found traces of the Egyptian dominion under the Pharaohs of the 17th and 18th Dynasties, rock-tablets with the shields of the two first Thuthmosis and of the third Amenophis. Farther on, at Sesebi, there were the remains of temples of the first Sethos of the 19th Dynasty. The great Temple of Soleb, built by Amenophis 3rd and 4th, detained us five days. The ruins of the Temple of Sedeinga, and those upon the island of Sai, belonged to the 18th and 19th Dynasties. Opposite this island stood the remarkable Temple of Amara, which was built by the Kings of Meroe and Naga, and is still an important proof of the extent of their dominion.

Semneh was the next point, we reached. The Nile is here compressed within a breadth of only about 1150 feet, between high rocky shores. On both sides there are ruins of old Temples of the 18th Dynasty. But these were not the earliest buildings which were erected here. We found a considerable number of inscriptions from the 12th and 13th Manethonic Dynasties, especially on the large foundations of the Temple of Kummeh, situated lower down, opposite Semmeh on the eastern bank, as well as on the scattered rocks on both banks in the neighbourhood of that Temple. Many of them were intended to indicate the highest risings of the Nile during a series of years, especially in the reigns of the Kings Amenemhe 3rd and Sebekhotep 1st, and by comparing them, we obtained the remarkable result, that about 4000 years ago the Nile used to rise at that point on an average twenty-two feet higher than it does at present. This, therefore, which we saw before us was the most ancient Nilometer, and the earliest statements of the heights, and their greatest number, were recorded during the reign of the same King, the Moeris of the Greeks, with whom we had already become acquainted in the Faium, as the great hydraulic architect. The strong fortifications on both banks of that narrow part of the river convinced us at once that, during the early times of the 12th Dynasty, this remarkable point served as the boundary of the Egyptian dominion, against the Ethiopian nations who dwelt more to the south.

At Wadi Halfa, on the 30th of July, we again left the cataract country, remained from the 2nd to the 11th Aug. in Abu Simbel, examined until the end of the month the ruins of Ibrim, Anibe, Derr, Amada, Sebua, Dakkeh, Kuban, Gerf-Hussen, Sabagura, Dendur, Kalabscheh, Debot, and spent the whole of the following month in examining the monuments of the island of Philæ, and the islands of Bigeh, Konosso, Sehel, and Elephantine, surrounding it, and of the stone quarries between Philæ and Assuan. October was spent visiting Ombos, the two Silsilis, Edfu, the desert Temple of Redesieh, El-Kab, Esneh, Tod, and Erment.

On the 2nd of November we again arrived on Theban ground, and first visited the rock-tombs of Qurnah, on the west side, where we remained nearly four months, till the 20th of February, 1845, when we encamped for three more months at Karnak. The number of monuments of all kinds both above and below ground at Thebes, is so great that they may be truly called inexhaustible even for a combined power like ours, and for the limited portion of time which we were able to devote to their investigation. But the age of the monuments at Thebes, is almost exclusively limited to the New Monarchy; and the most ancient we discovered, such as one might generally expect to find, are not earlier than the 11th Manethonic Dynasty, the last but one of the old Monarchy; for this simple reason, because it was in this Dynasty that Thebes

* Extracted from "Letters from Egypt, Ethiopia, and the Peninsula of Sinai," by Dr. Richard Lepsius.—*Continued from page 152*

became a royal residence, and hence the focus of Egyptian splendour. The great break in the succession at the end of the 12th Dynasty, caused by the invasion of the Hyksos, and their dominion, which lasted many centuries, first drove the Egyptian power back into Ethiopia, and at length entirely destroyed it, till the powerful Pharaohs of the 17th, 18th, and 19th Dynasties again advanced from the south, drove back the Semitic intruders, and raised the power of the Egyptian empire to its summit. The greater proportion of Theban monuments date also from this period. As we may suppose they have been the principal object of investigation to all travellers, therefore our work here had been for the most part anticipated.

Nevertheless it was necessary to re-examine the whole ground most carefully, partly to complete the deficiences left by our predecessors, partly to make a proper selection of those monuments which were of most importance for our particular purpose, and which we were anxious to insert among our collections, either in the shape of a drawing or an impression upon paper, or even in the original itself. We directed our principal attention during the whole journey, and especially here, to taking the most exact architectonic plans of all the buildings and other localities which appeared to us to be of any consequence; and for this purpose we did not hesitate to make extensive excavations. By this means we succeeded, amongst other things, in discovering and recording for the first time, a perfect plan of the most beautiful of all the Temple buildings, namely, the Ammon Temple, built by Ramses 2nd, which is described by Diodorus under the name of the sepulchre of Osymandyas. We made several excavations also in the valleys of the royal tombs, and opened, for instance, the rock-tomb of the same Ramses 2nd, one of the largest of those which have hitherto been accessible. Unfortunately, the interior chambers were so much destroyed by the dirt and rubbish that had fallen in, that we could make out little more from the representation upon the walls than the proprietor of the tomb.

Accompanied by the artist Max Weidenbach, I made an intermediate journey from Karnak to the Peninsula of Sinai. We went thither by the old road from Koptos to Aennum (Philotera), now leading from Qeneh to Koser, which conducted us first to the remarkable stone quarries of Hammamat, already worked out during the old Monarchy. The numerous rock-inscriptions, which date as far back as the 6th Dynasty, occupied us here for five whole days. From this place we passed through the Arabian chain of mountains to the north, as far as Gebel Zeit, where we embarked for Tor, situated opposite. We ascended through Wadi Hebran to the convent, and from thence through Wadi e Schech, Wadi Firan, W. Mokatteb, W. Maghara, by Sarbut el Chadem, down again to Abu Zelimeh, where we got into our vessel, to return to Koser and Thebes.

As early as the 4th Manethonic Dynasty, between three and four thousand years before Christ, this Desert Peninsula was subject to Egypt, and was principally colonised by the Egyptians on account of the copper mines, which are there met with on the limits of the primitive mountain range, and the surrounding sandstone mountains. Upon several rock-tablets of Wadi Maghara, the kings of those oldest Dynasties were represented fighting with the Semitic aboriginies, and the inscriptions of Sarbut el Chadem, were at least as early as the 12th Dynasty. We did not, also, lose sight of the great interest which is attached to these localities of the Peninsula in connection with the Old Testament. More especially, I believe, that I have succeeded for the first time (not accepting Burckhardt) in determining the correct position of Sinai, since contrary to the tradition of the convent, hitherto accepted, I did not recognise in it one of the southern mountains, but in Serbal, which is situated several days' journey more to the north, at whose base lies the only fertile oasis of the whole Peninsula. This opinion which has been already published in a preliminary account of the journey, addressed to the King of Prussia, has met with frequent oppositions, but has also latterly received much approbation, I believe, in a special treatise upon the question, by W. Hogg, printed in the last half of the "Transactions for the Royal Society of Literature." (1848) I have not hitherto been able to discover any material counter-arguments in the discussions which have been held upon the subject, but, on the other hand, much stronger evidence that, contrary to the later Byzantine tradition, the more ancient Christian, and probably the Egyptian tradition itself, considered Serbal, at whose foot the oldest convent was situated, to be the true Sinai.

On the 14th of April we returned to Thebes, and finally left it on the 16th of May. On our way back to Lower Egypt, we re-examined more minutely the monuments of Schenhur, Dendera, Hou, Abydos, Echmim, El Bosra, Tel el Amarna, and El Hibe, and on the 27th of June, our party, which had been increased at the last stage by the addition of Dr. Bethmann, again entered Cairo.

I was detained there myself some months longer than the other members of the expedition, in order to direct the transportation of several sepulchral chambers in the neighbourhood of the great Pyramids, and to superintend the embarkation of the valuable blocks of stone, together with the other monuments, which we brought with us from Upper Egypt and Ethiopia, and which the Viceroy Mohammed Ali sent as a present to his Majesty the King of Prussia. In this troublesome as well as important affair, for the practical performance of which four experienced workmen had been expressly sent from Berlin to Egypt, I had only the kind assistance of Dr. Bethmann, who accompanied me on an independent footing during the remainder of the journey back.

After a final visit to Alexandria, we embarked on the 25th of September at Cairo for Damietta, but on the way visited the ruins of Samanud, Behbet, and the Ramses Temple of San, (Tanis) and left Egypt on the 1st of October, in a vessel which took us to Jaffa. After we had traversed the whole length of Palestine, and from Jerusalem had visited the Dead Sea, and from Beyrout, Damascus, and Baalbec, at the mouth of the Nahr el Kelb, the ancient Lykos, we came upon the last Egyptian monuments in the north, namely, those celebrated memorial-tablets, which the great Ramses 2nd engraved beside the old Military road, as a recollection of his warlike and victorious Asiatic compaigns in the fourteenth century before Christ. After a period of more than 3000 years, neither the form, nor even the Name-Shield of the powerful Pharaoh, at whose court Moses was educated, had been destroyed by the destructive sea-air. On one tablet, indeed, I was able to distinguish the date of the fourth, on another that of the second year of his reign.

According to the testimony of Herodotus, similar monuments of Sesostris are also found in Ionia, and some time ago, one which he describes as being there, was re-discovered. But an excursion from Smyrna to that spot soon convinced us that the rock-picture of Karabel was produced by an Asiatic and not by an Egyptian chisel.

Lastly, we saw in the Hippodrome, at Constantinople, the obelisk of the third Tuthmosis, but, like others, sought in vain for the second, which earlier travellers would have us believe that they had seen. On the 24th December, I left Constantinople, and landed on the 5th January, 1846, in Trieste.

The whole journey, of which this is a very hasty sketch, was one of the most fortunate expeditions which has ever been under-

taken for a similar purpose. None who participated in it suffered from the climate or the accidental casualties of a journey. We travelled under the powerful and in every way efficient protection of the Viceroy. We had an explicit and written permission to make excavations, wherever we should consider it desirable, and we employed it, to acquire a number of interesting monuments for the Royal Museum at Berlin, which would either have remained in Egypt as rubbish under the sand hills, or exposed, like so many others, to be destroyed for all kinds of material purposes.

(To be continued.)

The Austrian Imperial Printing Office.*

The Imperial Printing Office of Austria has exhibited the whole collection of the new applications of the typographical art, such as the galvanoplastic process, galvanography, galvanoglyphy, and chemitypy, which, bringing their co-operation to the aid of typography, enable it to reproduce, in some degree, nature itself. It may, therefore, be said that these new branches are to typography what photography is to the art of drawing.

The Galvanoplastic Process.—We have, for instance, seen antediluvian fishes reproduced upon paper, at this exhibition, with the exactness of nature itself. By means of successive layers of gutta percha applied to the stone inclosing the petrified fish, a mould is obtained, which, being afterwards submitted to the action of a galvanic battery, is quickly covered with coatings of copper, forming a plate upon which all the marks of the fish are reproduced in relief, and which, when printed at the typographic press, gives a result upon the paper identical with the object itself. M. Hulot, a mechanist and chemist attached to the mint of Paris, has exhibited some sheets, each of them containing three hundred heads intended for postage stamps, which are impressed at one stroke from a plate of brass of a single piece, containing these three hundred figures in relief. By a peculiar process, M. Hulot succeeds in identically reproducing, without the least contraction, the original engraving, which is on steel, but which might be engraved on any other metal, or even on wood. It is by this same process that M. Hulot has reproduced, for the Bank of France, the notes engraved in relief in such perfection by French artists.

Galvanography.—The Austrian Printing Office has shown us some remarkable results of this process. An artist covers a plate of silvered copper with different coats of a paint composed of any oxide, such as that of iron, burnt terra sienna, or black lead, ground with linseed oil. The substance of these coats is of necessity thick or thin, according to the intensity given to the lights and shades. The plate is then submitted to the action of the galvanic battery, from which another plate is obtained, reproducing an intaglio copy, with all the uneveness of the original painting. This is an actual copper-plate, resembling an aquatint, and obtained without the assistance of the engraver.

Galvanoglyphy.—The experiments in galvanoglyphy are no less interesting. Upon a plate of zinc, coated with varnish, a drawing is etched; then, with a small composition roller, a coat of ink is spread upon this varnish, and left to dry. The ink is deposited only on those parts where the varnish has not been broken through by the graver, and leaves the sunken portion of the engraving free. When the first layer is dry, a second is applied, then a third, and so on, until it is considered that the original hollows are deep enough. The plate thus prepared is placed in the galvanic battery, and another plate is the result, on which all the hollows of the engraving are reproduced in relief. This relief is more or less raised, according to the number and thickness of the coats of ink successively applied. The process was invented in Englandand patented by Mr. Palmer, of Newgate Street.

Chemitypy.—For the purpose of obtaining casts in relief from an engraving, the process of chemitypy is equally ingenious. A polished zinc plate is covered with an etching ground; the design is etched with a point, and bitten in with diluted aquafortis; the etching ground is then removed, and every particle of the acid well cleaned off. For this purpose, the hollows of the engraving are first washed with olive oil, then with water, and afterwards wiped, so that there may not remain the least trace of the acid. The plate, on which must be placed filings of fusible metal, is then heated by means of a spirit-lamp, or any convenient means, until the fusible metal has filled up all the engraving; and when cold, it is scraped down to the level of the zinc plate, in such a manner that none of it remains except that which has entered into the hollow parts of the engraving. The plate of zinc, to which the fusible metal has become united, is then submitted to the action of a weak solution of muriatic acid, and as of these two metals the one is negative and the other positive, the zinc alone is eaten away by the acid, and the fusible metal which had entered into the hollows of the engraving is left in relief, and may then be printed from by means of the typographic press.

Paneiconography.—This is a new process, invented by M. Gillot, of Paris, and consists of a method of reproducing, by means of the typographic press, any lithographic, autographic, or typographic proof, any drawing with crayon or stump, or any engraving upon wood or copper. Upon a plate of zinc, polished by means of pummice-stone, the artist executes the required design with lithographic crayon or ink, or transfers impressions from lithography, wood engraving, or copper plates. The surface is then inked over with a roller, so as to increase the thickness of the ink, which is afterwards consolidated by dusting finely-powdered rosin over the plate by means of a pad of wadding; the rosin adheres only to the ink, and is readily removed from the other parts of the plate. Afterwards, for the purpose of obtaining a relief block, the plate is placed on the bottom of a shallow trough, containing very dilute sulphuric or hydrochloric acid. By means of a rocking motion given to the box, which, for that purpose, is fastened to an axis, the acid is caused to pass slowly and continuously to and fro over the surface of the plate. After the lapse of half an hour, if it be a crayon drawing, the etching is completed, and a relief block is obtained, in which it is only necessary to remove the large whites by saw-piercing. In case, however, of the plate containing written matter, or many very fine lines, it is necessary to withdraw it from time to time, and again ink the surface with lithographic ink, and dust the powdered rosin, so that the edges may be protected as much as possible from the undermining action of the acid. These operations must be repeated until the necessary depth is obtained. Transfers may be made from very old impressions of wood engravings, by sponging them several times at the back with acidulated water, and then operating as is usual with lithographic transfers.

* Reports of the Juries of the Great Exhibition.

Atmospherical Electricity.

BY PROFESSOR JOSEPH LOVERING, OF HARVARD UNIVERSITY.

Continued from page 159.

The third general division of this article proposes to inquire how it is that the earth becomes charged with electricity. I begin this inquiry by observing that there are three dynamical processes, very general and very efficacious, which are going on at all times

with greater or less violence in the air, all which probably are concerned in the production of the electricity we observe in it; namely, 1. Evaporation; 2. The friction of the wind; and 3. Combustion. As early as 1749, Franklin had a theory that electricity was produced by evaporation, and in a way which had some resemblance to Black's theory of specific heat. When water evaporates, it requires a greater capacity for electricity as well as for heat. The electricity and heat, essential to the physical change of state involved in the transition of matter from a liquid to a gaseous state, must be abstracted from surrounding bodies which are thus cooled and left, electrically speaking, negative. As the vapor rises with its latent charge of heat and positive electricity, it finally reaches a region of cold where it is again condensed, and the electricity and heat become free again, and make some demonstration. Thus, if Franklin had reasoned by strict analogy, he would have made the charge of the clouds positive, whereas at this time he was under the impression that they were negatively electrified. In 1767, he had come to the opinion that the vapor is often positive. In the mean while, that is, in 1752, Nollet had made experiments upon evaporation. In 1782, Volta published his experiments upon electricity as a product of evaporation; especially that which he made by a mixture of water, sulphuric acid, and iron filings, in the presence of Laplace and Lavoisier. Saussure and Bennet also experimented on the evaporation of various liquids and from various vessels they remark that the *kind* of electricity developed in the vapor was often anomalous. Saussure suggested, that in some cases a chemical decomposition of the liquids might take place, or perhaps even of the vessel, which disguised the genuine result of evaporation. Pouillet, who has gone largely into the subject of the origin of atmospherical electricity, has come to the conclusion, that the material of the vessel which holds the evaporating water has much influence, and that pure distilled water develops no electricity by evaporation; and that the saline or other impurities which water generally contains are in some way essential for the production of electricity by evaporation. If, says Bird, common salt be put into the water which is passing into vapor, the vapor acquires positive electricity at the cost of the vessel, which is negative. If, on the other hand, acid is mixed with the water, the vessel takes the positive charge and the vapor goes up with a deficiency of electricity. Peltier has made many experiments upon the subject, and finds, as he thinks, something besides evaporation to be necessary to the production of electricity, and something the conditions of which can hardly be found in ordinary evaporation. It is proper, also, to add this fact given by Pouillet, that Lemonnier discovered electricity in the air every day for six weeks between the middle of September and the end of October, 1753, although the season was very dry and no clouds were seen. On the other hand to prove that evaporation developed electricity, Rowell and Spencer made an experiment which showed that, where electricity was cut off by insulation, the evaporation was retarded. For this purpose, they put the same weight of water into two vessels, one of which was insulated, and the other connected with the ground by conductors of electricity, and they always found that the latter lost the most by evaporation. I will give the following method of Howard for showing the electricity of evaporation: "To the cap of a gold-leaf electroscope I affixed a horizontal support for a candle, which projected two feet from the cap of the instrument placed near the edge of a table; on the floor, immediately beneath, was an earthen vessel containing hot water an inch in depth. The candle being lighted, two or three hot coals were dropped into the water, so that there rose a sudden cloud of vapor. The electricity of this being collected by the candle, the leaves of the electroscope opened and struck against the sides."

Another cause of atmospherical electricity, and the one upon which Reiss particularly insists, is friction. Faraday shows by experiment that dry air, rubbing against dry air or against some other substance, would be inactive in respect to electricity. But moist air grinding against the hills, the trees, the rocks, would acquire a positive charge of electricity. The friction of two masses of moist air driven by opposite currents against one another might charge each, though with different kinds of electricity, and to a less degree than where the two rubbing bodies are more heterogeneous. Kæmtz, the distinguished meteorologist, relies on the efficacy of friction,—of friction between strata of air differing in temperature as well as moisture, of which the coldest, and therefore generally the highest, takes the positive charge. In elucidation of this point, I may refer to the discovery by Armstrong, in 1840, or hydro-electricity, as it is called. When high pressure steam issues from a boiler through a stopcock, lined, for example, with partridge-wood, electricity is abundantly produced; the steam and water being charged positively and the boiler negatively. The elaborate experiments of Faraday have clearly shown that the cause of the electricity in this case is friction; not the friction of the steam, but of the liquid particles mixed with the steam, against the inside of the pipe. Dry steam will not answer. Hence the apparatus makes provision for cooling and condensing, by a circuitous channel artificially chilled, a part of the steam before it escapes, so that it may contain the particles of water which do the rubbing. The steam itself is the mechanical power which works the electrical engine. The hydro-electric machine accordingly differs from the ordinary friction machine for producing electricity, incidentally in employing steam power instead of manual labor to work it, but essentially in selecting drops of water and wood for rubbing in place of glass and the usual amalgamated rubber. Leave now the workshop and the laboratory and go out into the broad atmosphere, substitute for the working power of steam that of the wind, and you have a hydro-electric machine of Nature's own handiwork, and upon a magnificent scale. I will offer only two further remarks concerning friction, as one of the contracting parties for forging the glittering artillery of the clouds. 1. As friction of the air is inoperative without moisture, evaporation in the last analysis is to be thanked for the electricity which friction produces. 2. As the friction of moist air, as it is driven before the wind, must be one cause, if not the only or principal cause, of atmospherical electricity, have we not some elucidation of the thunder and lightning which accompanies many moist storms, and makes so dazzling a part of the retinue which marches in the track of the tropical hurricane and the tornado everywhere!

Vegetation and combustion must not be omitted in making a catalogue of the sources of atmospherical electricity. Pouillet inferred from experiments, that the oxygen which plants give out by day is charged with negative electricity; and that a surface of one hundred square metres in full vegetation produces as much electricity in one day as the largest Leyden battery can contain. Kæmtz lays some stress on combustion as a generator of atmospherical electricity. The carbonic acid gas carries off with it positive electricity.

This experiment of Matteucci may have some applicability to the subject. He insulated a metallic plate of three square feet, covered with earth and salt; as soon as the sun acted upon it, the gold leaves of an electroscope connected with it diverged.

After it has been proved that an assigned cause is of the right kind in quality, the demands of a rigid science are not satisfied unless it is also shown that it is of sufficient force in quantity. In the case under consideration, it may be difficult to

do all this, it may be difficult to calculate from such data as exist how much electricity is concentrated on the average in the atmosphere at any one time for which an accouut is to be rendered; and it may be no more easy to estimate correctly the producing power of evaporation, friction, and their co-operatives. There are few of the mechanical operations of nature which can be brought within the limits of strict mathematical investigation. The precision of delicacy of finish, united with great boldness of conception, which are claimed for astronomy, belong only to the mechanics of the solar system, and this which is called the higher mechanics is considered piecemeal. It hath not yet entered into the mind of man to conceive of that highest and truly celestial mechanics which metes out the forces ordained to balance and move not merely planets and comets, but stars, clusters, and nebulæ. Here it is the multiplicity of the stars which swarm in space, and the unnatural and parallactic crowding in certain districts, which make the confusion of thought. In meteorology, and indeed on many an arena of nature infinitely smaller than the earth's atmosphere, there is the same multitude of objects, and the same ambiguity of their position; and besides all this, there is a variety of forces which cut in at various points besides the force of gravitation, and there also exist an irregularity of figure and a crowding of parts in the matter concerned, which contrast widely with the almost spherical units and the ample spaces of astronomy. To walk even in one of the narrowest paths of meteorology, who can compare numerically the quantity of electricity which diverges the tell-tale leaves of the gold-leaf electroscope and that which fills the Leyden jar, and then who can compare the quantity in the jar with that in the thunderbolt, and afterwards say how many such thunderbolts strike upon a certain assignable area of the earth's surface, and how much electricity besides this discharges silently and steadily upon the mountain-peaks, the million tree-tops, and the innumerable natural lightning-rods which point ever to heaven, and preserve the earth from frequent and violent electrical excitement, by bringing the electricity back harmlessly to the earth? And to account for the existence of so much electricity, after its value has been accurately ascertained, who can calculate, from the electricity which the evaporation of a drop of water contributes to the sky, how much ascends from the earth's waters? And who will undertake to calculate the friction of the winds and the electricity which they grind out?

Beccaria, who was one of the first to follow the lead of Franklin in pursuing the study of atmospherical electricity, estimated that, as much electricity passed through the rods on the palace of Valentino every hour as was sufficient to kill three thousand men. Arago estimated that, when a cloud was present, a hundred sparks would pass a break in a lightning-rod in ten seconds, and this would be enough to kill a man; enough, therefore, to kill three hundred and sixty men an hour. In respect to evaporation, Leslie computes, that 52,120 million cubic feet of water, each weighing about sixty-two pounds, are lifted 18,000 feet into the air by evaporation each minute. Now if the evaporation of a drop of water develops electricity sufficient to throw apart the gold leaves of the electroscope, who can say that the whole fund of evaporation, which is mechanically equivalent to 200,000 times the labor of the working population of the globe, may not be competent for all the requirements of electrical meteorology.

The last general division of this article has to do with the effects of atmospherical electricity. There are meteorologists who, in their discussions and theories have entirely overlooked the agency of electricity. There are other meteorologists, who have exalted the electrical forces into the first rank, and placed them in the van of the great movements in the atmosphere. Both of these views, in my opinion, are at variance with the truth. The electrical forces are not to be despised on the one hand, nor, on the other, to be enthroned above every other influence. The statistics of meteorology are various, and are collected for various purposes. But the most important questions of meteorology, considered as a science, relate to motion. The statical aspect of this science is valuable as showing when equilibrium cannot exist, and where there must be motion, and how much motion, there must be. The phenomena of meteorology are emphatically those of change and transition. The dynamical side of the problem contemplates the laws of these changes and the origin and character of the forces which produce them. The degree of change and its direction are conveniently gauged and registered by the difference in the barometric height at the same moment for two places, or for the same place at two successive periods. But the cause of the oscillation in the barometer and of the motions which are measured by them is to be found in a disturbance of the mean temperature or humidity, or both, of the air; a disturbance originating, in each case, directly or remotely, in the action of the solar rays. While evaporation is going on under the provocation of the sun, and while the winds are blowing in virtue of moisture and of heat, both the winds and the evaporation produce electricity. This electricity, acts by its own laws of attraction and repulsion, and produces motions which combine, according to the established principles of mechanics, with the other motions which heat immediately causes; or one of the effects of heat, that is, gravitation disturbed by vapor. If we take a glass-plate electrical machine, and suppose it to be turned by a wind-mill instead of by manual strength, and if we apply the electricity which it generates to almost any mechanical purpose, we shall see that it would do much less execution than the wind itself which was spent in producing the electricity. Or if we examine the hydro-electric machine, the boiler of a locomotive, for example, we discover that it can generate large sums of electricity, surpassing, perhaps, all that we have ever seen produced artificially. Collect now the electricity which this maximum of art produces, husband it carefully, dispose it so as to exert to the best advantage its mechanical power, and how much work can it do compared with the locomotive which generated it? If it were harnessed by any artifice, however skilful to the heavy train of freight which the locomotive hardly feels to press upon its Herculean shoulders, would it not be utterly crushed by it? Hence we infer that in meteorology the work which is done by electricity is small in comparison with that which is done by the heat, acting through the wind and moisture, which sets free this electricity. And if it were otherwise, if heat could act with more economy through the medium of electricity than through that of elasticity or gravity, or through any other medium, would a thorough analysis of the phenomena of meteorology be satisfied with stoping at the electrical forces? Would it not finally come to the sun's heat as the prime mover and disturber? So it would appear that, although the phenomena of meteorology are limited to this planet, the cause is cosmical and not metoric.

Without regarding electricity as the exclusive or even the principal force which manifests itself in meteorology, we may refer certain classes of phenomena to its more particular agency. Of this description is the aurora. The great elevation of the aurora, in many cases, might require us to consider it as without the pale of meteorology, did we not expand the limits of the earth's atmosphere, and therefore the limits of the science

which treats of it, beyond the region of twilight to a spot as distant as any of which gives indications of the existence in it of any substance affiliated with the grosser matter of the earth. Now the relation which has been observed to hold between the direction of the dipping needle at any place and the vanishing point of the auroral beams, indicates a dependence of the aurora on terrestrial magnetism, that is, upon an inseparable property of the earth. Again, it is supposed the clouds do not shine entirely by the light of the sun, but that they are themselves to a small degree self-luminous. In proof of this, Mr. Spencer alleges the case of an astronomer who could not see to read his time by bright starlight, but was able to do it after the heavens were overcast with clouds. Now it has been suggested that these instances of phosphorescence in clouds are the effects and the tokens of their electricity. The meteoric wonders of luminous rain and snow may indicate a high charge of electricity in the air breaking out into a glow. In other cases, as for example, in the moon, the planets, and the comets, where it is known that the bodies shine eminently by reflected light, that small amount of independent light which they may emit from a sort of phosphorescence is liable to be overlooked and over-drenched in the superior brilliancy of other lights; but these independent rays, where they exist, may be the nice traces of electricity.

There are motions among the clouds which are probably caused by the electrical attractions and repulsions. It is no uncommon sight to behold clouds moving contrary to the wind, and also sometimes in different directions with respect to one another. This is properly explained, in many cases, by saying that different currents prevail at different heights, and each cloud obeys, like a balloon, the current in which it happens to be at the time. But it is impossible that the clouds should be electrified, as they sometimes are to a high degree, without exerting their electrical attractions and repulsions, and thus producing motions which may modify, and perhaps materially, such other motions as the winds may start. On the 14th of June, 1842, it was observed that the focus of a thunder-storm in England followed the course of the Thames. There, the electrical forces seemed to impress their own character upon the direction of the motion. The clouds acted by induction upon the earth, and, particularly on those parts which conduct the electricity best, and prepared the way for the attraction which guided their own course.

Another way in which electricity may influence the atmospherical movement is this. When the particles of air are electrified, they tend to fly asunder, as the pith-balls hanging upon the prime conductor of the electrical machine. This tendency of the particles to separate adds to the expansive force of the air, and is equivalent to so much additional heat. A large amount of electricity set free at one place may give a strong explosive force to the air, and produce in this way very grand effects, though they will be local and ephemeral in their character. But in a general view of meteorology this mode of action cannot be paramount to all others. For when it is considered that heat acting by one or another agency, produces the electricity which is in the air, it can hardly be believed that a given amount of heat if exerted directly on the air to expand it.

Faraday once made a remark, based upon his own experiments, which is often quoted and sometimes misconceived, to this effect: that a grain of water gives out by its chemical decomposition as much electricity as might charge a thunder-cloud. Hence many exclaim, philosphers and those who are not, How immense the *quantity* of electricity in a drop water! We might with as good reason cry out, How insignificant the quantity of electricity in the thunder-cloud! And, indeed, if electricity be in reality a fluid, as we at present are constrained to conceive it, the grand effects which are unquestionably produced by it, as those of the thunderbolt, may be attributable to the incomparable freedom, elasticity, and consequently the velocity of the fluid, and not the quantity, which may be no greater than that which binds the oxygen and hydrogen of a particle of water, and which if gradually set free, is insignificant and almost imperceptible. There may be other local effects besides these seen where lightning has struck, as for example, the ravages of the tornado, which are the work of electricity suddenly accumulated and bursting as suddenly out before it has had time quietly to discharge itself by the ordinary channels. In the convulsions of the air, and even of the solid earth, in earthquakes, volcanic eruptions, and hurricanes, electricity finds a congenial atmosphere and contributes to swell the force of destruction. But even here, while its makes it own mark on the phenomena, it is itself the effect of many antecedents, and can be no larger or more terrific than the forces which have been expended in producing it. These other forces, it is true, by taking the guise of electricity, may acquire a degree of centralization and a facility for instantaneous action which do not belong to their own sluggish nature.

Thus, in various ways, such as have been already described, electricity is ascending from the earth to the air, or in other words, the electrical equilibrium holding between the earth and its atmosphere is destroyed. Even while the accumulation is proceeding, some effects, as the electrical attraction and repulsion, and the motions which follow, are produced by these forces, the release of which from the usual balance is the essence of electricity. But in the course of time the clouds will be electrically overloaded, and the forces of which I write will be so strengthened by constant reinforcement as to compel a return to equilibrium. The influences which carry up the electricity into the air cannot hold it there. This must be left for the insulating power of the air itself, which is generally very imperfect. In dry states of the air, the electricity must wait till it is strong enough to break down in luminous beams through the dry air, revealing its motion possibly at these times by the tremulous flashes of the aurora. Sometimes its passage from cloud to cloud is bridged across by the moisture, or its descent to the earth is made very easy by the columns of rainbows or snow-flakes. But whether it creeps slyly from place to place or dashes boldly along, as in the lightning, the most important disturbances are produced by the electricity of the atmosphere, as well as electricity in general when it is in motion, when it is hurrying back to the haunts from which it was enticed. Then it burns, blazes, storms, and tears, then it convulses and sometimes kills. Manifest pains has been taken by the Author of nature to keep down all electrical excesses. The lightning which kills suggests most forcibly the Merciful Hand which generally spares. Even if we are not able to decide whether the development of electricity is incidental merely to other atmospheric movements, or whether it is a most important object of them, certain it is that electricity is crowding into the air, and in quantities that would threaten all the time, did not Infinite Wisdom provide in more ways than one an escape for the redundant energy, and ages before Franklin planted on the earth the first lightning-rod to catch the destructive fluid as it poured down, make the earth bristle all over with his divine protection. The method by which the earth is shielded from the electrical furies, the cases in which the defence is insufficient, the ways by which man has guarranteed to himself greater security, and the effects of lightning when, in spite of

all caution, human and divine, it is occasionally allowed to strike the earth with violence, will make a proper subject for another communication.

General Meteorological Register of the Provincial Magnetical Observatory, Toronto, for the Year 1853.

Read before the Canadian Institute by Prof. Cherriman, Feb. 11th, 1854.

The mean temperature for the year 1853 has been above the average of the previous 12 years by 0°.55, the months of January, May, July, October, and December having been below, and the remaining months above, the corresponding average temperatures. The hottest month was August, and the coldest January, which is an exception to the normal curve where these months are July and February.

The month of August is the hottest in the whole series of years, except July, 1850. The *climatic difference,* or the difference between the hottest and coldest months, is 45°.6, being 2°.9 greater than the average. The range of temperature during the year has been 104°.6, occurring from —9°.7 on the morning of Jan. 16th to 94°.9 on the afternoon of Aug. 11th, this latter being the highest temperature ever recorded at the Observatory.

The hottest day was Aug. 12th (79°.8), and the coldest Dec. 29th (2°.4), the difference between these being 77°.4. The greatest daily range occurred on Jan. 15th, amounting to 40°.9, while the mean daily range on the average of the whole year is 16°.9.

The present year, therefore, conforms to the law established by Colonel Sabine from the preceding 12 years' observations, that "the climate of Toronto presents a remarkable combination of great regularity in the annual temperature with great variability occurring in the course of the year." Arranging the year into the ordinary seasons, we find the mean temperatures to be as follows:

Winter, 26°.3; Spring, 41°.1; Summer, 66°.6; Autumn, 47°.3;

in each case being above the average.

By an inspection of the thermic anomalies, it will be seen that only two months of the year have been above the normal values of this latitude, all the rest being more or less below. Taking the respective seasons, we find the thermic anomalies to be:

Winter, —8.2; Spring, —8.4; Summer, —0.7; Autumn, —5.5;

and if we increase these temperatures by 1° on account of vertical elevation, the summer will have been 0°.3 above, and the winter 7.2 below, the temperatures due to those seasons from our geographical position.

The most remarkable deviations from the normal curve of temperature have been as follows:

From Feb. 1st to 5th inclusive, mean deviation	+9°.8
" Feb. 7th to 9th	—9°.7
" Feb. 28th to March 2nd	+9°.1
" March 14th to 16th	—18°.3
" June 13th to 16th	+12°.7
" Aug. 10th to 13th	+12°.3
" Sept. 2nd to 6th	+9.5
" Nov. 19th to 23rd	+12.5
" Nov. 24th to 25th	—11.6
" Dec. 28th to 31st	—14.6

The greatest deviation below the normal was on 29th Dec., 22°.7, and above, on 14th June, 14°.4.

The mean humidity of the year is .79, July having been the dryest, and January and February the most moist months. The extent of clouded sky on the average of the whole year has been .57, so that nearly three-fifths of the sky has been overcast on the mean of the whole. The clouds were least prevalent in July, and most in December, and no less than seven months have been on the average more than half overcast.

The mean direction of the wind has been N. 38° W., with a mean velocity of 5.08 miles per hour. For the first six months the mean direction was steadily from the N.W. quarter, changing very suddenly in July to the E. and S., and returning in December to the N.W. The velocity was greatest in February, diminishing regularly till June, when it was least, and then increasing again.

The amount of rain fallen has been 23.55 inches on the surface, which is 8.076 inches below the average; and if to this we add 5.32 inches for the amount of rain equivalent to the 53.2 inches of snow that fell during the year, we have a total of 28.87 inches. On the whole, this has been the dryest year, with the single exception of 1848, during the last 13 years. The greatest amount fell in September, and the least in December, the summer months being remarkably dry.

The fall of rain was distributed over 109 days, and the snow over 52, leaving 204 perfectly fair days, on which neither rain nor snow fell. Of these, January enjoyed the most (24), and February and November the least (9).

Frost occurred in every month except June, July, and August, the latest in spring being on the 20th May, and the earliest in autumn on the 12th September. The last snow of spring was on the 10th May, and the first of autumn on the 25th October, being about the usual periods. Toronto Bay was clear of ice on March 31st, and frozen over on December 19th, being crossed on foot on the 21st.

The Indian summer was well defined from 12th to 20th October.

The number of thunder-storms during the year has been 34, of which the most occurred in June and September; none at all in November, January, and February. Of these, there were only six remarkable for violence, viz., on 15th, 17th, and 18th of May, all passing from W. to E.; on 15th July, from W. to E., accompanied with heavy hail; on 17th August, from W. to E., passing directly over the Observatory; and the most violent of all on 14th September, during 10 minutes of which the wind attained a velocity of 46.8 miles per hour, the greatest ever recorded here.

During the year there have been 233 nights the state of which would have permitted Aurora to be seen if it existed. On 57 of these Aurora was actually observed. The most brilliant displays occurred from May 28th to June 1st; from July 8th to 12th; on August 25th; and from September 1st to 3rd. This latter was visible not only over most of this continent, but also in Europe, presenting the same characteristics. All these were accompanied by great magnetic disturbance.

General Meteorological Register for the Year 1853. Provincial Magnetical Observatory, Toronto, C. W.

Latitude 43° 39′·4 *North*; *Longitude* 79° 21′·5 *West*. *Elevation above Lake Ontario*, 108 *feet* *Approximate elevation above the sea*. 342 *feet*.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean of Year.
Mean Temperature	22°.98	24°.06	30°.65	41°.92	50°.87	65°.49	65°.60	68°.61	58°.81	44°.40	38°.68	25°.32	44°.78
Difference from Average	—1.99	+0.66	+0.42	+0.78	—0.31	+4.44	—0.81	+2.45	+0.79	—0.53	+2.17	—1.43	+0.55
Thermic Anomaly	—9.8	—10.6	—9.5	—8.3	—7.2	+0.9	—3.1	+0.1	—2.7	—9.4	—4.5	—10.7	—6.2
Highest Temperature	40.9	43.4	56.3	65.7	78.4	89.5	91.3	94.9	85.5	64.7	55.6	46.4	
Lowest Temperature	—9.7	—1.4	—0.1	25.0	32.2	39.2	41.6	42.5	33.9	23.4	12.8	—8.4	
Monthly Range	50.6	44.8	56.4	40.7	46.2	50.3	49.7	52.4	51.6	41.3	42.8	54.8	48.47
Mean Daily Range	14.16	14.40	14.82	14.07	14.19	19.77	23.80	21.41	18.42	20.51	13.01	14.14	16.89
Greatest Daily Range	40.9	35.4	26.0	28.8	28.4	32.8	30.7	39.1	32.2	31.5	27.6	24.9	
Mean Height of Barometer	29.7121	29.5824	29.5533	29.5689	29.5979	29.6175	29.6552	29.5907	29.6421	29.6485	29.7921	29.5984	29.6299
Highest Barometer	30.315	29.937	30.168	29.974	30.074	29.982	29.906	29.850	29.999	30.066	30.270	29.984	
Lowest Barometer	28.653	29.074	28.892	28.985	29.213	29.265	29.274	29.300	28.946	28.985	29.159	28.952	
Monthly Range	1.662	0.863	1.276	0.989	0.861	0.717	0.632	0.550	1.053	1.081	1.111	1.032	0.986
Mean Humidity	.82	.82	.81	.80	.80	.79	.70	.74	.79	.75	.81	.81	.79
Mean Elasticity	0.110	0.117	0.145	0.212	0.297	0.491	0.425	0.513	0.399	0.223	0.201	0.122	0.271
Mean Direction of the Wind	N. 27° W.	N. 49° W.	N. 62° W.	N. 12° W.	N. 20° W.	N. 14° W.	E. 14° S.	E. 61° S.	N. 5° E.	W. 2° S.	N. 1° E.	N. 38° W.	N. 38° W.
Mean Velocity of the Wind (Miles)	6.34	7.29	5.87	5.20	5.14	3.67	3.70	4.23	4.30	4.72	5.52	4.98	5.08
Mean of Cloudiness	0.68	0.74	0.59	0.46	0.57	0.43	0.34	0.47	0.53	0.49	0.74	0.75	0.57
Amount of Rain (Inches)	0.290	1.030	1.080	2.625	4.420	1.550	0.915	2.575	5.140	0.875	2.425	0.625	23.550
Difference from Average	—1.535	+0.023	—0.481	+0.023	+1.534	—1.532	—2.762	—0.415	+0.839	—2.198	—0.628	—0.944	—8.076
Amount of Snow	7.5	12.6	7.1	1.0	Inapp.					Inapp.	2.7	22.3	53.2
No. of Fair Days	24	9	17	19	13	21	21	20	18	19	9	14	204

Meteorological Observations at Hamilton.

HAMILTON, 8*th Feb.*, 1854.

To the Editor of the Canadian Journal.

SIR :—I enclose herewith, for publication in your *Journal*, if you see fit, the mean results of my meteorological observations for the last eight years.

At the time my observations were commenced, I was aware that a daily morning and evening observation would give a near approximation to a correct annual mean temperature. I was also aware that from horary observations at Leith, in Scotland, conducted at the suggestion and under the auspices of Sir David Brewster, it was found that the proper times for the morning and evening observations there, were 9¼ A. M., and 8½ P. M., but that from the examination of a register kept at these hours at Alford, in Aberdeenshire, Sir David calculated that the proper times at that place for giving the mean temperature were 8¾ A. M. and 8 P. M. I selected, therefore, at first, two hours most convenient to myself, marking, at same time, the daily highest and lowest, intending at some future time to calculate the times at which the observations might be made to correspond more nearly with one another, and with the mean temperature. I also made a series of monthly observations on the temperature of a spring of water.

The thermometer used was one by Troughton & Sims, of London, which was tested, and found correct; but, after being used for some time, the steel rod got entangled in the mercury oftener than once, and was with difficulty extricated. I therefore got another thermometer, which, after being used for two or three years, was broken. In 1839, finding that the exclusion of the daily maximum and minimum did not affect the mean temperature by more than from one to two tenths of a degree, I only marked the monthly maximum and minimum, and used the old thermometer, not suspecting that it had become incorrect; nor was this suspected till 1846, when it was found to stand two degrees too high. In the end of that year, I therefore got a new thermometer, by Dunn, of Edinburgh, which has been used since. I mention this to account for the observations of Capt. Lefroy in your *Journal* for Nov., 1852, and for the apparent high temperature of 1846, which should, in consequence, I believe, be reduced two degrees. That the position of the thermometer within the Venetian blind of a window, in a northern exposure, was not improper, was ascertained from frequent comparison with another thermometer, hung under a pine-tree at the same height from the ground.

I will only farther remark that the thermometer is about 8 feet from the ground, and that the column headed "slight showers" implies not exactly what it expresses, but that the rain was not such as to prevent out-of-doors work for more than two hours. The sum of the two first columns gives the number of days on which rain or snow more or less fell.

Should any further explanation be deemed necessary, I shall be happy if you will give me an opportunity of making it.

I am, sir,
Your obedient servant,
W. CRAIGIE.

Mean Results of Meteorological Observations at Hamilton for Eight Years—1846 to 1853 inclusive.

1846.

	Thermometer.			Highest.	Lowest.	Barometer.			Rainy days.	Slight showers.	Dry days.
	Mean at 9 A.M.	Mean at 9 P.M.	Mean of both			Mean.	Highest.	Lowest.			
Jan. ...	29°.2	30°.4	29°.8	51	4	29.657	30.30	29.22	3	9	19
Feb....	24.54	24.4	24.47	48	-4	655	21	28.97	5	7	16
March	38.16	35.82	36.74	58	10	66	14	29.00	4	9	18
April..	47.16	44.93	46.05	85	26	774	22	17	5	7	18
May ...	62.645	57.323	59.984	85	35	608	29.92	25	4	7	20
June ..	70.43	64.13	67.28	90	45	704	30.10	40	2	8	20
July ..	77.87	67.0	72.435	98	49	70	08	37	2	7	22
Aug. ..	74.74	70.52	72.63	93	58	73	29.90	44	4	2	25
Sept. .	68.24	66.00	67.12	90	41	716	95	40	4	8	18
Oct. ...	48.065	48.645	48.355	76	25	753	30.17	30	7	8	16
Nov....	44.1	45.4	44.75	60	20	.7255	22	02	4	7	19
Dec. ...	31.74	34.2	32.97	58	16	.669	22	05	4	4	23
Mean			50.215			29.6955			48	83	234

1847.

Jan. ...	25.774	26.29	26.032	54	2	29.65	30.17	28.90	5	7	19
Feb. ...	25.786	27.678	26.782	45	2	594	03	86	4	9	15
March	32.42	32.48	32.45	54	10	69	05	29.15	2	3	26
April..	46.08	43.2	44.615	77	20	657	06	18	3	6	21
May...	59.54	55.26	57.4	84	34	665	00	20	2	7	22
June ..	67.16	61.4	64.28	90	41	649	29.96	10	3	9	18
July...	78.6	71.6	75.1	96	46	752	98	50	1	5	25
Aug. ..	71.19	66.13	68.66	88	48	75	30.02	42	2	7	22
Sept...	60.66	58.56	59.62	86	39	694	04	37	5	10	15
Oct. ...	47.9	48.03	47.965	72	24	707	34	07	4	7	20
Nov....	41.77	41.93	41.85	71	11	695	19	30	5	8	17
Dec. ...	32.7	33.8	33.25	58	10	667	02	28.97	5	11	15
Mean			48.168			29.681			41	89	235

1848.

Jan. ...	30.90	30.4	30.65	60	-1	29.685	30.22	29.05	4	7	20
Feb. ...	29.62	30 2	29.91	55	5	594	07	00	1	5	23
March.	32.55	32·45	32.5	72	6	642	29.95	19	4	6	21
April. .	46.2	45·9	46.05	84	26	777	30.09	38	2	5	23
May...	61.42	58·16	59.79	91	35	566	29.87	27	3	7	21
June. .	70.83	68·2	69.52	100	42	615	95	28	1	7	22
July...	70.32	68·8	69.61	94	51	628	80	23	1	9	21
Aug...	73.58	72·516	73.048	96	58	7065	88	33	2	5	24
Sept...	58.9	57·8	58.1	80	38	628	98	28.99	4	8	18
Oct. ...	51.096	50·77	50.933	78	32	677	30.18	29.22	3	6	22
Nov....	37.2	37·13	37.166	51	25	694	09	28.90	5	6	19
Dec. ...	34.41	34·13	34.27	60	13	649	12	29.05	5	9	17
Mean			49.295			29.663			35	80	251

1849.

	Thermometer. Mean at 9 A.M.	Thermometer. Mean at 9 P.M.	Thermometer. Mean of both	Highest.	Lowest.	Barometer. Mean.	Barometer. Highest.	Barometer. Lowest	Rainy days.	Slight showers.	Dry days.
Jan. ...	23°.20	24°.50	23°.85	53	–6	29.88	30.47	29.20	8	7	21
Feb. ...	22.714	25.142	23.928	49	–6	29.767	30.30	29.15	8	7	18
March	36.71	38.03	37.37	73	28	29.745	30.18	29.00	2	5	24
April..	42.4	42.64	42.52	77	22	29.676	30.00	29.15	1	8	21
May ...	52.86	52.64	52.5	84	35	29.7065	30.22	29.08	6	8	17
June ..	69.47	67.37	68.42	99	45	29.735	29.98	29.42	2	5	28
July ...	73.16	71.9	72.58	101	54	29.79	30.08	29.44	2	2	27
Aug....	70.16	69.9	70.03	98	53	29.728	29.90	29.26	2	7	22
Sept. ..	61.93	61.66	61.8	89	40	29.766	30.15	29.18	1	5	24
Oct. ...	48.968	49.486	49.227	75	30	29.657	30.02	29.20	6	8	17
Nov....	45.966	46.5	46.233	68	30	29.629	29.95	29.25	5	5	20
Dec. ...	29.16	28.55	28.855	55	8	29.683	30.24	29.27	5	10	16
Mean temp. of year,			48 105	M'n h't.		29.726.			38	77	250

1850.

Jan. ...	30.61	31.35	30.98	50	15	29.71	30.18	28.96	6	8	22
Feb. ...	29.428	31.50	30.464	59	8	29.593	30.26	28.78	5	5	18
March	33.00	33.74	33.37	60	14	29.626	30.22	28.70	2	6	24
April..	41.46	40.9	41.19	80	21	29.614	30.05	28·95	5	6	19
May ...	53.60	51.4	52.50	90	36	29.619	30.00	29.00	1	5	25
June ..	70.56	68.1	69.83	95	46	29.738	30.00	29.50	0	8	22
July ...	74.29	73.39	73.84	101	56	29.691	29.88	29.48	5	5	21
Aug....	71.74	70.97	71.355	100	52	29.691	29.95	29.40	5	7	19
Sept...	61.76	60.43	61.1	86	37	29.715	30.02	29.44	3	5	22
Oct.....	49,30	49.7	49.5	78	31	29.657	30.00	29.30	3	8	20
Nov. ...	42.00	43.73	42.866	74	22	29.717	30.10	29.30	4	5	21
Dec. ...	28.355	28.225	28.29	52	0	29.70	30.22	29.10	7	8	16
Mean temp. of year,			48.732	M'n h't		29.673			46	71	249

1851.

Jan. ...	29°.61	32°.16	30°.885	52°	–6°	29.665	30.42	28.88	5	5	21
Feb. ...	33.00	33.20	33,100	57	9	29 805	30.36	29.28	5	6	17
March	37.774	396774	387257	75	21	29.693	07	30	2	6	23
April..	44.76	45.7	45.23	77	29	64	30	15	4	6	20
May ...	56.45	55.45	55.95	88	31	71	10	24	2	8	21
June ..	65.83	64.16	65.00	92	43	65	06	18	3	8	19
July ...	69.94	70.00	69.97	97	53	639	29.86	40	4	8	19
Aug....	68.13	67.77	67.95	91	49	749	30.02	50	4	5	22
Sept...	63.06	63.00	63.03	96	36	838	30.25	25	5	3	22
Oct. ...	50.2	50.51	50.35	77	27	6375	00	28	2	8	21
Nov....	38.43	38.13	38.28	53	26	652	40	02	4	7	19
Dec. ...	26.16	26.80	26.48	52	0	68	20	28.90	5	9	17
Mean temp. of year,			48.756	M'n h't.		29.6882			45	79	241

1852.

Jan. ...	22.87	24.645	23.76	45	–6	29.59	30.00	29.05	7	9	15
Feb. ...	28.00	29.20	28.60	54	–2	579	82	28.72	2	9	18
March	32.90	33.10	33.00	58	5	684	82	72	6	5	20
April..	41.80	41.73	41.77	69	26	475	29.85	95	6	8	16
May ...	57.61	56.00	56.805	88	35	71	30.15	29.20	2	5	24
June ..	66.66	65.26	65.96	98	44	633	00	15	3	8	19
July ...	71.61	70.55	71.08	101	52	721	29.95	30	2	4	25
Aug....	69.80	69.00	69.40	97	52	768	30.00	46	2	9	20
Sept...	60.70	60.30	60.50	95	38	764	02	05	5	5	29
Oct. ...	52.58	52.32	52.45	76	34	72	10	30	5	4	22
Nov....	39.16	39.73	39.45	57	27	645	17	07	3	6	21
Dec. ...	35.709	36.645	6.177	59	18	641	20	10	8	6	17
Mean temp. of year,			48.248	M'n h't.		29.657			52	78	237

1853.

	Thermometer. Mean at 9 A.M.	Thermometer. Mean at 9 P.M.	Thermometer. Mean of both	Highest.	Lowest.	Barometer. Mean.	Barometer. Highest.	Barometer. Lowest.	Rainy days.	Slight showers.	Dry days.
Jan. ...	28°.46	29°.22	28°.84	50	8	29.7525	30.28	28.97	1	5	25
Feb. ...	28.14	28.82	28.48	50	10	636	00	29.15	5	5	18
March	35.355	36.71	36.03	66	7	615	18	28.95	4	7	20
April..	45.9	45.9	45.9	88	29	6725	00	29.07	4	5	21
May ...	56.5	54.9	55.7	92	38	6775	15	82	4	10	17
June ..	70.06	68.66	69.36	98	50	737	05	50	2	5	23
July ...	71.322	70.968	71.145	97	52	749	29.95	50	1	4	26
Aug. ..	72 8	72.9	72.85	101	51	679	90	40	2	6	23
Sept...	63.9	63.96	63.98	96	37	728	30.00	20	8	5	22
Oct. ...	47.26	48.26	47.76	75	30	718	08	10	6	6	25
Nov....	42.9	44.22	43.56	65	20	834	25	30	4	4	22
Dec. ...	30.355	29.903	30.129	58	2	687	04	00	4	8	19
Mean	49.413	49.535	49.474			29.7025			84	70	261

Meteors and Falling Stars.

Read before the Canadian Institute, February 4th, by T. Henning, Esq.

The subject to which I would invite your attention for a few minutes this evening, is one of an interesting though mysterious character. It is at the same time one which is gradually assuming the form of a science, and, from its connection with other branches of general physics, beginning to awaken a closer and deeper interest. The higher principles of inquiry into nature, the infinite increase of exactness required and obtained in all the methods of research, and the intimate connection established amongst different sciences, which are said to be the peculiar characteristics that designate the physical science of the present time, are strikingly illustrated in the investigations of scientific men, into the various phenomena presented by *aerolites, meteors,* and *falling stars.* The scientific research which has been given to the subject, has broadened the views of the philosopher, who, until lately, agreed with the peasant in ascribing "those fiery shapes and burning crescents" which suddenly kindle into brightness and as suddenly disappear, to inflammable gases or electrical action in the atmosphere. True, there are many questions connected with this subject which have as yet received no very satisfactory solution, still the number of such is gradually diminishing, and the theories adopted to account for the origin of such phenomena, in which much confidence is placed, are now limited to one or two. The truth can only be ascertained by a lengthened process of observation and experiment, not confined to one locality or country, but extending throughout different hemispheres and different latitudes. In a clear and cloudless atmosphere, such as we possess in Canada, good opportunities are afforded for marking the course of the fire-ball as it moves through the blue vault of heaven, or for noticing the point whence issue those showers of "fiery shapes" which periodically visit us. So far as I am aware these favorable opportunities are but rarely embraced; for in the catalogues that have been compiled, shewing the recorded observations of such phenomena, I have not been able to find the name of Canada bearing any very conspicuous position. I trust that this will not continue so much longer; and that the effect of this and similar institutions, in stimulating to increased

observation and research in the different departments of physical knowledge, may be visible in this, as I have no doubt it will be, in many other portions of the great field of science.

My object in this paper is not to present any new theory for your adoption, or to invite attention to any original views on the subject to which it refers, but rather to state summarily the leading questions connected with luminous meteoric phenomena, so as to elicit the opinions of those scientific gentlemen whom I have the pleasure to address, and with whom I have the honor to be associated in this Institute.

It may be observed at the beginning that what have been called *shooting-stars*, *fire-balls* and *meteorites*, are generally regarded as being closely connected in character. Although possessing many distinct characteristics, careful observers tell us that fire balls cannot be considered as entirely separate from shooting-stars. Humboldt observes, that both these phenomena are not only often simultaneous, but often found to merge into one another, the one gradually assuming the character of the other, alike with respect to the size of their discs, the emanation of sparks and the velocities of their motions; but, he adds in a later work, that *relation* is not *identity*, and that much remains to be investigated as to the physical relations of both. Again, the connection of meteorites and fire-balls, and of fire-balls and shooting-stars has been proved by facts of an indubitable character. Whilst most writers, therefore, on these phenomena have, to the great perplexity of the unscientific reader, failed in their attempts to treat of them separately, still a certain classification has been adopted as the basis of inquiry into the causes and physical connections of such phenomena; and although expressive of little more than mere external aspects, irrespective of the physical causes of such appearances, such a classification is useful, and to it I shall adhere as far as possible in what follows.

We have then 1st, balls of light, appearing suddenly, presenting certain physical characters, and as suddenly disappearing; 2nd, shooting-stars, visible at all times and in all countries; and 3rd, aerolites or meteorites, differing in size and form, but possessing certain features indicative of a common origin, and that foreign to the planet on which they fall.

The spirit of inquiry into the nature of these bodies began to awake about the close of last century, and from that time to the present, extensive research has been employed to ascertain the early history of certain aerolites, reports of which were common to all ages, but which have only recently become the subject of historical evidence. The ingenious and fanciful Edward King thinks that he finds a reference to these in the "hailstones and coals of fire" mentioned by David in the 18th Psalm; and also in the "great stones" with which Jehovah discomfited and slew the five kings who made war against Gibeon. For the knowledge of the most ancient falls of aerolites, which are determined with chronological accuracy, we are indebted to the industry of the Chinese. They possess authentic catalogues of the remarkable meteors of all classes, aerolites included, which have appeared in China during a period of 2400 years. Their reports therefore reach back to the time of Tyrtaeus, and the second Messenian war of the Spartans, or 179 years prior to the fall of the large meteoric stone at Aegos Potamos, which Pliny describes as being as "large as a cart," even in his day; and which Humboldt thinks may yet be found, notwithstanding the failure that attended the efforts of the African traveller, Brown. Edward Biot, who has translated these records, has found sixteen falls of aerolites for the epoch from the middle of the seventh century B.C., to the 333rd year of the Christian era; while the Greek and Roman writers mention only four such phenomena, as having occurred during the same space of time. He mentions also, that during the three centuries from A.D. 960 to 1270, not fewer than 1479 meteors are registered by official observers employed for the purpose. In 1794 the celebrated work of Chladni was published, and was the means of arousing general attention throughout Europe to the whole subject. In that book a catalogue is given of all the recorded observations of fire-balls, and other meteors which had been previously made; and by the time that his second work appeared in 1819, containing a full account of aerolites, registered according to the periods and places of their fall, as well as the directions of their line of descent, all scepticism on the subject had vanished, and his statements were received with entire assent by the scientific portion of his readers at least. His work, too, had the effect of calling more general attention to those ferruginous masses which had been found in different countries, and of assigning to them a meteoric character. I refer to such masses as those found in Otumpa and Bahia in Brazil, the former of which weighed about 14,000 pounds, or such specimens as that of the Siberian stone described by Pallas, and which is now in the Imperial Museum, in St. Petersburg. I may notice that the number of aerolites registered by Chladni, as having fallen from the commencement of the Christian era down to 1818, is 165. Between 1600 and 1818, seventeen of these fell in Britain, fifteen in France, and seventeen in Germany. From Chladni's time to the present day, almost every country has supplied not only observers but collectors of these curious stones, of which large quantities are to be seen in every European Museum, and not a few in the cabinets of scientific gentlemen in the United States.

The name of Professor C. U. Shepard, is well known for his enthusiasm in collecting and investigating these extraordinary bodies. He has recently deposited in his magnificent cabinet at Amherst, U.S., a metallic of a most interesting character. "This specimen is entire, of an elongated ovoidal form, and covered with the usual indentations. It appears to be compact malleable iron, exhibiting the characteristic crystalline figures, and weighs 178 pounds. It was discovered in the Great Lion River, in the Nemaqua Land, in South Africa, and, having been transported several hundred miles in wagons to the Cape of Good Hope, was shipped to London. Professor Shepard, being in the city at the time of its arrival, immediately entered into negociations to obtain possession of this miniature world, and, with considerable difficulty succeeded. Besides this prince of meteorites may be seen another stranger, belonging to the same *high-born* noble family, from Newbern, S. C., weighing 58 pounds. This collection of extra-terrestrial substances weighs more than 350 pounds, and includes 200 specimens from more than 100 different localities."

There is also a large mass, weighing about 3000 lbs., in the Natural History Lyceum in New York, which was found at the Red River, in Louisiana. It is stated in the January No. of *Silliman's Journal*, that Prof. Smith has found a meteorite in East Tennessee, which weighed at first over 60 lbs. It is a highly interesting one, having furnished for the first time the solid protochlorid of iron found in a fissure. It is also rich in phosphuret of iron and nickel, and furnishes material for a full investigation of this latter mineral.

During the night, meteorites are generally observed to fall from fire-balls; during the day, from a small, suddenly-formed dark cloud in a clear sky, though sometimes the cloud is wanting. Generally, the fall is accompanied with a very considerable crackling noise, and the stone when found is sometimes in a heated state. Although possessing much general resemblance to each other,

to this similarity there are exceptions regarding individual points. Hence, by some mineralogists these meteoric masses have been distinguished as those containing nickeliferous meteoric iron, and those consisting of fine or coarsely-granular meteoric dust. All that have yet been found, with one exception I believe (that of Chantonnay, in La Vendee), have been covered with a thin crust, or rind, only a few tenths of a line in thickness, of a deep, black colour, occasionally veined and sprinkled over with small asperities. This crust is generally divided from the inner light-grey mass by a sharply-defined line of separation, and bears marks of having been subjected to an intensely powerful heat. Amongst the first who instituted the chemical investigation of meteoric stones, were Vauquelin and Berzelius, who examined them only for their constituent elements, which they made to consist of 15 in number, viz., iron, nickel, cobalt, manganese, chromium, copper, arsenic, zinc, potash, soda, sulphur, phosphorus, and carbon. Farther examinations by the Roses of Berlin, Prof. Rammelsberg, and Prof. Shepard of Amherst, have added to the number, so that the actual number of recognized elements are no fewer than 19 or 20. Prof. Rammelsberg, as quoted in Vol. IV. of Humboldt's *Cosmos*, says: "Of the *simple substances* hitherto detected in the meteoric stones, there are 18—oxygen, sulphur, phosphorus, carbon, silicium, aluminum, magnesium, calcium, potassium, sodium, iron, nickel, cobalt, chromium, manganesium, copper, tin, and titanium. The *proximate* constituents are: (1) metallic: nickel-iron, a combination of phosphorus with iron and nickel, sulphuret of iron and magnetic pyrites; (2) oxydized: magnetic iron ore, and chrome iron ore; (3) silicates: olivin, anorthite, labrador, and augite." Cobalt and nickel are the most invariably present, but iron is the ruling ingredient. The specific gravity of some of these stones amounts to as much as 4.28, while in other cases it is as low as 1.94.

FIRE-BALLS.

We may now briefly notice the peculiar features of fire-balls and falling stars, reserving the theories that have been proposed regarding the origin of meteoric stones as applicable to the whole. These meteors appear to move in the arcs of great circles, and to come from certain particular directions. No movement of rotation has been recognized in them. Their apparent discs are doubtless greatly overrated from optical causes. Occasionally they seem to exceed the circumference of the full moon, which, at the distance of 110 miles, would give a diameter of about a mile. The amount of light given out by them is much less than that of the moon. As to the altitude of meteors, very great difference of opinion obtains. The first series of observations for determining this point, as well as their velocity, were made by Brandes and Benzenberg in Germany, in 1798, and repeated (by Brandes and others) in 1823. The altitude varied from 4 to 80 miles, a few from 180 to 240 miles, and the velocity from 18 to 36 miles in a second. The velocity, as shown by the results of M. Quetelet's observations in Belgium in 1824, was about the same as the translatory velocity of the earth—*i. e.*, 16.4 miles. Heis and Houzeau have lately given the result of observations, making the velocity of some shooting-stars to be between 46 and 95 miles in the second, consequently 2 to 5 times as great as the planetary velocity of the earth. According to the existing measurements, fire-balls appear to move slower than shooting-stars; but, at the velocity stated, it is astonishing that they do not sink deeper into the earth, only one being known to have ploughed up the earth to the depth of 18 feet. The visible duration of meteors seldom exceeds a few seconds, although occasional instances of longer duration are recorded. Capt. Shortrede saw a meteor at Charka, in India, in 1842, which, with its train, was visible for nearly five minutes. The most notable instance of this sort is that of Jenny Lind's meteor, seen from Boston on the 30th Sept., 1850, and which remained visible for an hour. On the 1st April, 1851, a very brilliant one was seen at Aden. It was mistaken by the sentry at the Turkish wall for an alarm-rocket, and he discharged his musket accordingly, giving the usual notice and thus summoning to arms from their midnight slumbers the whole garrison of 4000 men.

Perhaps one of the most extraordinary meteors that ever appeared in England was seen from two independent stations in the parish of Beeston, about the 1st Nov. last, at 3 h. 57 min., p.m, and, of course, in broad daylight. Had this phenomenon occurred at night time, it would have been a glorious object. The following particulars are given in a letter to the *Times* newspaper, by E. J. Lowe, Esq., of the Beeston Observatory: "The meteor moved nearly perpendicularly down, inclining to east. It was first seen as a circular body, of about half the apparent diameter of the sun, being accompanied by a stream of light; afterwards it increased to almost the diameter of the sun, and then burst into fragments with an explosion. The report of the explosion was from 1 sec. to 3 sec. after the meteor had disappeared, and resembled distant thunder. The meteor passed over about 15 deg. of space, disappearing 30 deg. E. of N., at an altitude of about 10 deg.; duration, 3 sec. It was very brilliant, shining with a somewhat yellow light. Soon afterwards, near the spot where it had disappeared, a band of prismatic colours was visible, being 2 deg. wide and 5 deg. in length. This phenomenon when first perceived was as brilliant as a rainbow, but soon faded, finally disappearing in about 5 min. Clouds were dispersed over the sky, from behind one of which the meteor appeared, afterwards vanishing behind another. The prismatic colours were seen upon clouds, or shining through them. Another observer informed him afterwards that the meteor at first moved more obliquely than afterwards; it three times burst into fragments, and was distinctly observed to pass beneath a cloud.

According to Mr. Lowe, meteors may be divided into three classes: 1st. Those with luminous streaks; 2nd. Those with separate stars, and those without any appendage; and 3rd. Those large bodies with well-defined discs. The first class, he thinks, may shine by *inherent light*, or be surrounded by a *luminous atmosphere;* the second class by reflected light, as described by Sir John Lubbock; and the third class may be purely atmospherical. As this kind nearly always move in paths discordant to the direction of the other meteors, they are not always spherical, and sometimes change their form. "I have seen them alter their colour from blue to red, and in one instance I saw a meteor of a blue colour give out orange-red sparks. Mr. Hind tells me he saw a green meteor turn to a crimson colour." From 4000 observations, collected during nine years, it has been inferred by Schmidt that 2-3rds of the shooting-stars are white, 1-7th yellow, 1-17th yellowish-red, and only 1-37th green. As to the curious fact alleged by some observers, that meteors and shooting-stars appear now and then to ascend, or to alternate in ascent and descent, as if new and opposite forces were brought into play, Bessel and others think it improbable. It perhaps requires still further observation and research. Great diversity of opinion prevails as to whether meteors are always associated with some form of matter analogous to that of known aerolites; but the presumption is strong that meteoric elements are present in all of them, whether precipitated or not. The first formal catalogue of remarkable meteors of all kinds was that made by Quetelet, and published first in 1837, and again in 1841. Then followed the catalogue of Mr. Herrick, in the United States, and that of M. Chasles, in

Paris, in 1841. Since then, however, Professor Powell, of Oxford, has collected every recorded meteoric appearance in any portion of the globe, and has published the result of his most extensive researches in the Annual Reports of the British Association for the Advancement of Science, for the years from 1847 to 1852.

(*To be continued.*)

On the Duration and Expectation of Life in Canada compared with other Countries.

Notice of a Paper read before the Canadian Institute on Saturday, January 28th, 1854, by Geo. H. Dartnell, Esq.

After giving a brief account of the progress of the doctrine of probabilities, particularly as applied to life contingencies, a history of the various tables now in use among actuaries, and an explanation both of their nature and of the manner in which they are used, Mr. Dartnell proceeded to state that,—

In framing tables of life adapted to Canada, difficulties of no ordinary character have to be surmounted, as, even at the best, a great portion of the data themselves must be deduced from various sources, and only after the most careful calculation. These difficulties chiefly arise from the fact, that, in this Province, no general records of births and mortalities exist, as in the mother country, where the registration of every birth, death, and marriage is rendered compulsory by law. It may be some years before the utility, and, indeed, the necessity of the introduction of such registration may become apparent in Canada; until then, the data on which we have to work is uncertain and liable to error.

In the table which is published with this paper, and arranged in columns are included the tables of life expectation from the following sources, viz.: the Northampton, the Carlisle, Breslau or De Moivres, the French or Des Parcieux, the Belgian, the Swedish, and the Canadian. The expectation of life has only been taken for quinquennial periods, that being quite sufficient for the purposes of comparison with other countries. The expectation of Canadian life for the ages prior to sixteen will not be found in the table. However, it may be here remarked that child life in Canada, except among very young infants, is nearly equal to English or foreign life at the same ages, the great deficiency being found to range between the ages of thirty and forty-five or fifty, after which time Canadian life rapidly improves, and at length in some of the older ages, becomes superior to that of other countries.

A curious fact in connection with Canadian life may here be noted. Almost all tables in which the sexes are distinguished unite in presenting this result, namely, that female life is better than male; and many offices proceed upon this assumption and grant annuities on female lives at lower rates than on males. In Canada this rule holds good in the earlier ages of life as far as the age of thirty, when the figures are for males 19.64, and for females 21.32, being a difference of more than a year and a half in favour of female life. Here, however, this superiority ceases to exist, for at thirty-five the numbers are, males 19.50, females 18.67; at forty the difference is still greater, the average life for females being 17.64, and that for females only 15.59; at forty-five the numbers are, males 15.57, females 13; at fifty the difference is not so great, the figures being for males 13.11, for females 12.50; and at fifty-five female life has regained its former supremacy, the numbers being 11.71 for males, to 14.13 for females. This superiority is retained for the remaining years of existence. In the Canadian table the expectancy of male and female life is combined, the difference not being great enough to warrant separation; besides the contrast between it and other countries will be more readily seen than if the table were divided into two, in addition to the fact that the excess at one period balances the deficiency at another.

A reference to the table will show that, until the higher ages of life are attained, Canadian life is inferior to almost all other countries—that this inferiority diminishes as life advances, and that in old age the chance of survivorship in Canada is something greater than at any of the places named in the tables. At the age of 15, the difference between Canadian life and Silesian and English (as shown by the Northampton table of life) is about 11 years—between the Carlisle 19 years, and between other countries something less. As life advances, this great difference diminishes gradually; for, at 45, life at Northampton is only about 5 years superior to that in Canada. At 50 the line approaches nearer. From 50 to 70 it is equal to some countries, and slightly inferior to others. At 80 it and the Carlisle touch the same point, and from that period till the end of life Canada is superior to the 6 others.

The unfavorable character of Canadian health, as presented by these tables, may be accounted for in various ways. As before remarked, they are purposely taken at as inferior a datum as possible, for the purpose of security. This alone would add throughout a considerable per centage to the table of Canadian expectation of life. Another cause may be assigned—the imperfect manner in which the census is taken in this country; for on two sets of calculations, founded on the census of 1842 and 1848, Canadian life was found to be better in the latter period from 2 to 10 per cent.; and there can be very little doubt that the last census will exhibit an equal improvement on that of 1848, chiefly arising from the greater accuracy with which these periodical "numberings of the people" are made, and that any calculations deduced from the data of the next census will tend to prove that Canadian life is at least equal, if not superior, to life in similar circumstances in England, and, consequently, to that in other countries.

The returns of burials in the cemeteries of this city for the four years ending 1850, afforded a datum upon which some time ago the writer formed a table of expectation of life. This agreed, allowing for fluctuations unavoidable in such a small number of deaths, in the main with those which are here presented. These four years embraced the period in which the cholera, the emigrant fever, and dysentry made serious ravages among the population of our city, and therefore would not be a fair test of the general state of health of Canada. Besides, any deductions made from the records of burials will be liable to an error increasing each year, if due allowance be not made for births and immigration—the latter an important item in our statistics.

The difficulties which attend the formation of a table of expectation for Canada on which dependence can be placed, might suggest a hint which perhaps might be useful at the next census-taking. If, in any one year, a complete census were made, registering the age of every individual, and of the deaths which took place in the 365 days next following the day of the census, were noted, the law of mortality could be deduced. In such case, the numbers living at every age would be so large, that the proportion of deaths among them in a single year could be safely depended on for pointing out, with great nearness, the law which regulates the mortality of large masses.

TABLE OF THE EXPECTANCY OF LIFE.

Age.	1. Northampton.	2. Carlisle.	3. Breslau.	4. France.	5. Belgium.	6. Sweden.	7. Canada.
0	32.74	44.68	43.00	......	32.02	42.95	......
5	40.84	51.25	40.05	48.27	45.07	46.79	......
10	39.78	48.82	38.00	46.83	43.09	45.07	......
15	36.51	45.01	35.05	43.51	40.05	41.64	25.38
20	33.43	41.46	33.00	40.22	37.08	38.02	23.67
25	30.85	37.86	30.05	37.17	34.07	34.58	21.49
30	28.27	34.34	28.00	34.06	32.00	31.21	20.48
35	25.68	31.00	25.05	30.88	28.09	28.08	19.09
40	23.08	27.61	23.00	27.48	25.08	24.66	17.38
45	20.52	24.46	20.05	23.89	22.07	21.61	14.24
50	17.99	21.11	18.00	20.38	19.05	18.46	13.66
55	15.58	17.58	15.05	17.25	16.04	15.58	13.31
60	13.21	14.34	13.00	14.25	13.04	12.68	12.16
65	10.88	11.79	10.05	11.26	10.08	10.10	10.62
70	8.60	9.18	8.00	8.64	8.04	7.72	9.31
75	6.54	7.01	5.05	6.50	6.04	5.91	7.37
80	4.75	5.51	3.00	4.69	5.00	4.28	5.60
85	3.37	4.12	.05	3.21	3.08	3.23	5.04
90	2.41	3.28	......	1.77	3.01	2.05	3.52
95	.75	3.53	......	......	2.01	1.00	1.19
100	......	2.28	......	......	.05	......	......
104	......	.50	......	......	......	......	......

Robert Stephenson, M.P.

(*Continued from page* 168.)

It increases the expense of the carrying department; the engines are more expensive, so are the tenders; the workshops from their size are also more expensive; the stations also require greater room. I think all the sidings are of a larger radius than those upon the narrower guage, in order to allow the engine to go through without grinding the rails or sliding upon them. In fact everything is upon an increased scale. The time-tables are so cumbrous that they cannot use them. * * * I see no good reason why the expenses of working should be less. There are several items which in my opinion tend to make it more. I believe the resistance of the wide carriages moving along the line of the broad guage to be more than upon the narrow guage."

Mr. Stephenson subsequently gave his evidence to the effect that the narrow guage afforded room for the construction of engines of ample power for working any trains that might be required; and that the power of the engines would in future be limited by the weight which the rails are capable of supporting. "We may build," he says, "engines upon the wider guage no doubt heavier and larger in dimensions and more powerful, but then you must make a road to support it on purpose." And with reference to the comparative speed on the broad and narrow guage, he says, "Every day we are running upwards of fifty miles an hour with our passenger trains, and those engines were not made with a view to attaining a maximum speed, but such a speed as we deemed then advisable to attain. We had never aimed to get our passenger trains upon the narrow guage lines to run more than 30 miles an hour, including stopages, therefore we had rarely if ever attempted a wheel larger than five feet six inches in diameter. On the North Midland I tried some of six feet diameter, and they are there constantly running 50 miles an hour. * * * There is no difficulty whatever in making an engine upon the narrow guage to take forty tons at sixty miles an hour, not the least difficulty, or even more than that." Again he says, "the wide guage engines are not more powerful, but they are heavier in proportion to their power. It is quite clear that every thing in the width of the engine, every thing that is to go across from side to side, is giving the engine no power at all; it is an incumbrance rather than otherwise." And generally on the comparative mechanical and commercial advantages of the two systems he says, "I believe it (the wide guage) is inferior in both ways. I believe it is less convenient because it requires larger stations; you are obliged to have a larger radius and more room for your sidings: at least you ought to have to work with the same facility. Commercially speaking, the advantage of the large truck, I am convinced, in nine cases out of ten is not felt at all, and in cases where the trucks are not filled and loaded to their maximum it is a positive disadvantage to the Company, which must fall upon the public eventually."

To the question of the safety of the two guages, Mr. Stephenson replies generally that, "As an abstract question I do not think there can be any line of difference drawn between the one guage and the other, in that respect they must be both alike."

Of course such decided opinions in reference to this important topic as were expressed by Mr. Stephenson, and which we have briefly quoted, were not left unchallenged; the broad guage interest, though comparatively small, had sufficient at stake in the extension of its lines to urge its representatives to the refutation of the arguments of its opponents, and Mr. Brunel, as the originator of the seven feet guage, entered with confidence upon the defence of his recommendation to the Great Western Company to adopt that guage. In his evidence before the guage commissioners, given subsequently to Mr. Stephenson's, he did not hesitate to claim many advantages for the broad guage. "Looking," says he, "to the speeds which I contemplated would be adopted on railways, and to the masses to be moved, it seemed to me that the whole machine was too small for the work to be done, and that it required that the parts should be on a scale more commensurate with the mass and the velocity to be attained;" and when questioned as to whether his experience of the broad guage had at all shaken his opinion of its advantages, he said, "I should rather be above than under seven feet now, if I had to reconstruct the lines."

The basis on which Mr. Brunel appears to have founded these opposite opinions to Mr. Stephenson appears to have been chiefly the anticipation of largely increased traffic, and a belief that it could be much more cheaply carried by stock of greater lateral capacity, while engines of larger power could be made at a reduced original cost for an equal amount of power, and that the power so obtained could be more cheaply worked. "The first cost," says he, "of the same amount of power is of course less in ten engines than it will be in fifteen, if that were the proportion, but I look rather upon it as to the efficiency of the result of the working of the whole machine than a mere question of economy in the first cost of the machinery, and taking the masses to be moved as varying from 60 to 70 or 80 tons in cases of passenger trains, and say 200 tons and 300 tons in cases of goods trains (and they very much exceed that frequently); but taking those masses, and taking the speeds to be what they will very shortly be, I have no doubt 50 and 60 miles an hour for passenger trains, and 30 for goods trains; I believe that, to carry those weights at those speeds efficiently, it is better to have larger carriages, and larger waggons, and larger wheels, and more powerful engines than those which have hitherto been used." He then goes into the question of

comparative cost of construction, which he makes out to be but little increased over the narrow guage, not necessarily in proportion to the increased width of way. He also treats the commercial question of a break in the guage in a very different view to that adopted by Mr. Stephenson, and considers the inconveniences likely to arise therefrom, unless occurring in the line of great through traffic, as of comparatively little importance.

In considering the opinions given on this question by the principal advocates of the rival interests, we are led to the conclusion that both have taken an extreme view of the case—views strengthened, undoubtedly, by the magnitude of the interests involved, and shared to a great extent by the professional gentlemen who gave their opinions before the Commissioners. Some of the latter, and among them Mr. Locke, considered that the most advantageous guage would lay between the two extremes. There can be no doubt that whatever that mean may be, the great extent of roads already constructed in England, and the vast amount of stock employed thereon, prevented any universal change to a wider guage than 4 feet 8½ in. It was also made apparent that such a guage was fully equivalent, both as regards the power and capacity of the rolling stock which the resources of the engineers of Britain had placed upon it, to the accommodation of a traffic as active as was likely to be in existence for many years to come. At the same time, we think strong reasons were offered to show that, where a large amount of traffic was probable, many advantages were offered by an increased width of guage; and especially may we instance the argument, that a given amount of power could be more cheaply created and maintained when developed in "*ten engines than when in fifteen.*" It is true, and was admitted, that engines as powerful, or nearly so, had been constructed on the narrow guage as had been constructed on the broad guage; and perhaps the same may hold true to this time. Yet we think there can be little doubt but a few inches greater breadth would be of great advantage to the narrow guage engines. Increase of length is not all-sufficient to increase of power in the most economical form, inasmuch as the friction of the heated air passing through the tubes requires increased force of blast to create the necessary draft, causing an equivalent increase in the back pressure in the cylinders; and moreover, though as large boilers had been crowded between the narrow guage wheels as had been found necessary, it had been effected by placing the framework outside the wheels, which is, in many respects, prejudicial to the strength and safety of the machine. There is also another consideration affecting this question in America, not so essential on English lines, and therefore less thought of in England. It is the advantage of being able to construct very powerful engines —engines capable of generating steam with great rapidity, and therefore competent to work an active traffic over the heavy grades which the small cost per mile of our roads necessarily involves. At present, this is of minor importance on Canadian railways, but its value is already felt on many lines in the United States, and as being a much cheaper mode of providing for increased carrying capacity on our roads than the reduction of their grades, it is not to be lost sight of. In view, therefore, of all these considerations—especially the latter—and also of the additional one that much of our traffic will, for several years, consist of the products of the forest, which will not bear a high tariff, and yet require a great expenditure of power for their transportation in proportion to their value, we think the railway legislation of Canada has been fortunate in fixing five feet six inches as the uniform guage to be adopted, and have no doubt but the additional width of nine inches between the wheels will be usefully employed in the creation of *cheap* power wherewith to surmount our grades, and bring our lumber and timber to market.

At the general election of 1847, Robert Stephenson was returned to the Imperial Parliament without opposition for the Borough of Whitby, in Yorkshire. He was returned on the conservative and protectionist interest, and as opposed to the endowment of the Catholic clergy, and to the repeal of the navigation laws. In the same year was commenced, under his supervision, the Tweed Viaduct, to which we have previously alluded—a work remarkable for its magnitude (2170 feet in length, and 125 feet in height), as being the largest stone viaduct in the world. Two years were spent on this work in obtaining foundations, for which purpose a fifty horse engine was constantly employed in pumping water from the coffer dams, and in driving piles for the foundations. The amount of masonry contained in this viaduct is upwards of a million cubic feet, and there are two millions and a half of bricks in the inner portion of the arches. This work was completed in August, 1850, and on the 29th of that month was opened by the Queen in person, who named it the "ROYAL BORDER BRIDGE." On this occasion, Mr. Stephenson was presented to her Majesty by Prince Albert, and was shortly after offered the honour of knighthood, which he respectfully declined.

In comparison with the Chester and Holyhead line, all the former works of Stephenson lose their great importance; and whether we consider the magnitude of the engineering works upon it, or its political and commercial importance in affording the means of a rapid communication between the capitals of the two kingdoms, we shall readily understand the feelings of pride with which Mr. Stephenson referred on a recent occasion to its successful completion.

Mining Insects.

At a recent meeting of the Entomological Society, London, —Capt. C. J. Cox presented specimens of the bark and wood of Elm and Ash, illustrating the different ways of mining pursued by the lavæ of *Cossus ligniperda*, *Scolytus destructor*, and *Hylesinus Fraxini*. From the vast and rapid increase of the Scolyti, extensive damage had already accrued to the elm trees in the parks and the neighbourhood of London, and also in many other places, and he was certain that unless means were speedily adopted to check the evil, in 60 or 70 years there would not be an elm tree near London. Contrary to the general notion, he had ascertained that sound young trees were attacked, rendered diseased, and ultimately killed by the injuries inflicted on them by Scolytus. By experiments in the gardens of the Royal Botanic Society, Regent's Park, he found that a diseased tree could be rendered sound and healthy by removing the bark from the the part affected, and destroying it :—the Cossus had been removed by cutting out, and the tree operated upon soon recovered. The injurious effect produced both by Scolytus and Cossus he attributed in a great measure to a poisonous quality in the excrement of the larva.—Mr. Westwood said Audouin had shown him, at Paris, that the female Scolytus first attacked a tree for food, and then other females followed and deposited their eggs in the exposed place.—Mr. Curtis had never known young trees attacked, and he doubted if any trees were infested until they were diseased or decaying from age.—Capt. Cox replied, that he had known the eggs laid on sound trees; that the insects eat into dead wood only after the bark and alburnum were exhausted; and that the trees in Regent's Park were growing vigorously when first attacked, and after being operated on recovered their health.

Paper from Wood Fibre.

In consequence of the scarcity of rags, and a prohibition of their exportation from various continental states to this country, some alarm has been excited respecting a deficiency in the supply of paper to meet the requirements of the age; and this is not to be wondered at, for the diffusion of knowledge by means of the press has become so vast, that we scarcely know anything short of a bad harvest which would be so much felt by the community as a limited production of this valuable commodity. We have the satisfaction of finding that, by the application of chemical science, the most important results, as regards the fabric of paper, have already been effected; nor do we believe that, since the papyrus was first used for writing, so important a fact has been established as that of the manufacture of paper from wood fibre. This extraordinary and valuable discovery has recently been patented by Messrs. Watt and Burgess, to whom the public is indebted for many valuable discoveries in chemistry. Two specimens of the raw material are before us: the first consists simply of deal shavings; the second of a pure white pulpy substance, very much resembling a piece of cotton when first taken from the pod, only a little harder to the touch. The manufactured article is declared by competent judges equal to any sample of writing paper now selling at 7d. per lb. It presents a beautiful surface, with a pure colourless tint, and is free from defect or blemish of any sort. The cost of production is stated to be somewhat under £25 per ton, which is a saving of more than £12 upon the price per ton of the rag paper now in use.—*Sun.*

INCORPORATED BY ROYAL CHARTER.

Seventh Ordinary Meeting, February 4th, 1854.

The names of the following candidates for membership were read:

T. Kellog.................Township of Brock.
Capt. Weatherly-....................Toronto.
Charles Stewart, Junior Member.......... "

The following gentlemen were elected members:

J. E. Ellis..........................Toronto.
A. J. Thibodo.......................Kingston.
G. P. Ure...........................Toronto

A donation from Mr. S. Fleming, C. E., of a conch shell, found on one of the Fishing Islands, Lake Huron, was announced.

A paper was read by Mr. T. Henning on "Meteors and Falling Stars."

Eighth Ordinary Meeting, February 11th, 1854.

The names of the following candidates for membership were read:

Collingwood Schrieber..................Toronto.
William R. Grahame....................Vaughan.
John Major...........................Toronto.

The following gentlemen were elected members:

T. Kellog.................Township of Brock.
Capt. Weatherly ....Toronto.
Charles Stewart, Junior Member.......... "

A donation from the Hon. East India Company of a copy of the Magnetical and Meteorological Observations made at Bombay in the year 1849, was announced.

An alteration in the Bye-Law relating to the balloting for members, of which notice was given by Mr. D. Crawford at the sixth ordinary meeting, was brought forward, and it was then

Resolved: That in section 8 of the Bye-Laws the words "if black balls to the amount of one-fourth appear" be substituted for the words "if one or more black balls"—

A Lecture was delivered by Professor Wilson "On some Coincidences between the Primitive Antiquities of the Old and New World."

The Meteorological report for the year 1853, containing a summary of the observations made at the Provincial Magnetical Observatory, was read by Professor Cherriman.

Ninth Ordinary Meeting, February 18th, 1854.

The names of the following candidates for membership were read:

William B. Heward...................Toronto.
Benjamin Workman...................Montreal.
Professor W. Andrew.................. "
Archibald Hall, M.D. .... "

The following gentlemen were elected members:

C. Schrieber........................Toronto.
W. R. Grahame.......................Vaughan.
J. Major ....Toronto.

A paper was read by the Rev. Professor Irving "On Solar Eclipses."

Tenth Ordinary Meeting, February 25th, 1854.

A donation from Mr. Peter Cameron, of Toronto, of a copy of Euclid's Elements, published in 1651, was announced.

The following gentlemen were elected members:

W. B. Heward	Toronto.
Benjamin Workman	Montreal.
Professor W. Andrew	"
A. Hall, M.D.	"

A paper was read by the Rev. Professor Parry "On the Early History of Ancient Rome."

Professor Chapman gave a short account of a specimen of Chlorastrolite from Lake Superior, and afterwards made some observations on the minerals presented to the Institute by Dr. Wilson, of Perth.

The Canadian Institute and the Toronto Athenæum.

Report of the Special Committees of the Canadian Institute and the Toronto Athenæum, appointed to confer on the subject of the union of those Institutions:

After consultation, it was agreed to recommend—

"That the Athenæum be merged in the Canadian Institute, transferring its books, minerals, and other properties (exclusive of such as may be necessary or are now used in the News Room), together with its present funds derived from Parliament, on condition,

"1. That the Library thus formed by the books of the two Institutions, with such additions as may hereafter be made from their common funds, shall constitute a Library to which the public shall have access for reference, under such regulations as may be adopted in view of the proper care and management of the same.

"2. That the members of the Athenæum shall become members of the Canadian Institute.

"3. That the Governors of the Athenæum shall be elected life-members of the Canadian Institute.

"Whereupon it was further agreed that each Special Committee shall report the above as a satisfactory basis for the proposed amalgamation, reserving matters of detail for future adjustment under renewed authority.

"That on the arrangements in detail being thus completed, a vote shall be taken by each body in Special General Meeting, which, if affirmative, shall provisionally establish the union, pending the passage of such an Act of Parliament (if any) as may be necessary to legalize the same.

(Signed) "THOS. D. HARRIS,
"*Chairman, pro tem.*

"ATHENÆUM ROOMS,
St. Lawrence Hall, Toronto,
14th February, 1854."

At a meeting of the Council of the Canadian Institute, held February 18th, it was

Resolved: That the Report of the Committee appointed to confer with the Committee of the Toronto Athenæum be adopted, and that they be authorized to complete the arrangements on the basis mentioned in their Report.

Chemical Composition of the Shells of certain Brachiopods.

At the close of the Seventh ordinary meeting of the Canadian Institute, Professor Chapman announced the following important discovery lately made by Messrs. Logan and Hunt, of the Geological Commission at Montreal. It is well known that the shells, claws, spines, and other hard parts of Articulated Molluscous and Radiated Animals, have been hitherto universally admitted to consist essentially, so far at least as regards their inorganic constituents, of carbonate of lime; whilst the bones of the vertebrated classes are mainly composed of the phosphate. In his "Cours de Palæontologie," Alcide d'Orbigny remarks on this subject, that the mean per-centage composition of the shells of acephalous molluscs may be thus represented:—carbonate of lime 95 to 96, phosphate of lime 1 to 2, water 1 to 1.5, animal matter 1.0. Messrs. Logan and Hunt, however, have now ascertained that the shells of both fossil and recent species of Lingula and Orbicula—two brachiopodous genera met with in rock formations of every geological age from the lower Silurian inclusive, and still existing in the Phillipine, Mediterranean and other seas—consist, not of carbonate of lime according to the usually received opinion, but of phosphate of lime. Shells of the fossil pteropod, *Conularia*, were also found to have a similar composition; a discovery tending to break down the presumed distinction between the skeletons of the Vertebrata, and the skeleton-analogies, so to say, of the lower types of organization.

In calling the attention of the Institute to these important facts, Professor Chapman mentioned that some time previously, he had himself detected phosphate of lime to the amount of 11.12 per cent., in the guard of a specimen of *Belemnitella mucronata* from the English chalk: but that he had attributed the presence of the phosphate in this particular instance, to metamorphic action during the fossilization of the substance.

In the case, however, of the recent brachiopods examined by Messrs. Logan and Hunt, such an interpretation would be manifestly out of the question. The scientific world will look with much interest for the further developement of this most fruitful discovery.

Toronto Harbour.

The following is the Report of the Corporation Committee on Wharves and Harbours. It is not a very encouraging document.

"Your Committee invited the Harbour Master, Hugh Richardson, Esq., and the Chief Engineer of the Esplanade, Kivas Tully, Esq., to accompany them, which these gentlemen kindly did, and from both of them your Committee have derived much valuable information, as to the changes which have been noted by them, from time to time in the Peninsula. Your Committee carefully inspected every part of the

Peninsula from the large gap below Privat's to the Light House point, and they regret extremely to have to report to the Council, that the whole of that barrier, which has formed, and has hitherto protected our noble harbour, is in a most insecure and unsatisfactory state. That part of it lying between the gap before referred to and Privat's Hotel, has been so far reduced in width, that it may be considered a matter of some doubt whether in the event of a succession of heavy easterly storms in the spring, it would continue to resist the encroachments of the Lake, or whether the greater part of it would not be swept away.

"That part of the Peninsula lying at the westward of Privat's, although comparatively of a much greater average width, and possessing one decided advantage over the eastern part, in the numerous trees growing upon it, (which serve that most important purpose of fixing and retaining the light and shifting soil,) is yet by no means secure. Although no actual breach has been made through any part of it, there were no less than four places between Privat's and the light house, where the water of the Lake, forced up probably by a heavy south-easterly wind, had flowed across into the Bay, carrying with it the fine sand, and leaving nothing but the coarse gravel and shingle behind.

"Under these circumstances, your Committee were unanimously of opinion that it would be unwise to permit sand to be taken from any part of the main ridge of the Peninsula; but being at the same time anxious that no restrictions not absolutely required for the safety of the harbour, should be imposed upon the supply of an article so necessary for building purposes, they directed Mr. Sheppard, who attended them on the part of Mr. Howard, the City Surveyor, to stake out a large piece of ground lying a little to the North East of the Light House, bordering on one of the numerous indentures which occur in the Western end of the Peninsula, formed by the small ponds running up between the spurs and projecting points of land, which jut out into that part of the Bay.

"By digging sand from these points no injury could accrue to the Harbour, and your Committee would therefore recommend that permission should be given by the Council to dig sand from the part so staked out. At the same time they would advise that the permission now granted should only be considered as temporary, and not binding on the Council beyond the present year, as the critical state of the whole Peninsula calls for the immediate adoption of some well digested plan for the preservation of that narrow belt of land, upon the safety of which the Harbour of Toronto may be said to depend for its very existence.

(Signed,) "G. W. ALLAN,
Chairman."

The Pompeian Court at the Sydenham Palace.

Every dweller in our great city will remember with delight those appointments so often made and so pleasantly kept in the fairy courts of the great edifice in Hyde Park a year or two ago,—when the trysting-place, as fancy or caprice suggested, was at the Crystal Fountain, under the tent of the Arab, in the court of Granada, by the Polar shores or at the source of the Ganges. Memories, almost magical in their variety and novelty, cling about those places, so often visited and revisited; and to the end of life, and far beyond the days of living men, these memories will hang about the world as strange and beautiful traditions,—the fanciful and poetic draperies of solid fact and prosaic purpose. Something like the old conditions may revive at Sydenham. Courts are there rising rapidly from the earth,—less significant, perhaps, in their moral meanings, but in form, embellishment, and contents far more rich and beautiful than the old. It may be well that, as reporters to our readers on the state of Art,—whether it be as to revival, novelty, or mere experiment,—we should render of these doings or misdoings some account.

The Pompeian Court is to most people a novelty. Stepping into it, the visitor steps, as it were, bodily into the first century of the Christian era. We are at once with Tacitus and the two Plinys. The water is idly plashing in the marble basin,—the master of the house appears to have retired for his mid-day sleep, as the dweller on the Bay of Naples does at the present day,—the slaves are probably cooking in the further corner,—and the rich, indolent, southern life is around us on every side. The illusion is perfect. Fancy can almost hear the voice of the great waters heaving through the summer silence,—and in the bright and golden splendour of the interior decoration the very spirit of Imperial Rome looks down in mingled luxury and passion from the walls.

What grace—what luxury—what artistic beauty visible everywhere! Yet Pompeii at its best was only the Worthing or the Dawlish of Italy.

Need we remind our readers that about seventy-nine years after the birth of Christ,—in the reign of the tenth Roman Emperor, Titus, the destroyer of Jerusalem,—Pompeii and Herculaneum, two small towns on the sea-shore near the foot of Vesuvius, and distant about 130 miles from Rome, were destroyed by an eruption? Herculaneum, the nearest to Vesuvius, was completly covered with the boiling lava; but Pompeii, the more distant, being only buried by the dust and stones, was, about a hundred years ago, explored, and the excavations have since been constantly pursued. Most valuable antiquities are discovered in the former place, as might be expected from the suddenness of its destruction.

As only about sixty bodies have been found in Pompeii, it is supposed that nearly all of its 5,000 or 6,000 inhabitants had time to escape with their chief valuables; but fear, duty or avarice detained some few until it was too late to escape. The sentinel has been found at the gate,—the lady at her toilette,—the miser clutching his bag,—the mother with her child,—and the prisoner in his chains.

The houses at Pompeii were small, the little city lying not far distant from those places of fashionable resort, Baiæ and Cumæ, the Bath and Cheltenham of the Roman nobles. The house here reproduced is as large as any yet found in the exhumed city, and is formed of the best portions of several houses. In comparison with the larger dwellings of the period which it represents, it is a Clapham cottage by the side of Buckingham Palace. The kitchen, here no larger than a cupboard, was sometimes 400 feet long in Roman houses; the entire space occupied is that of a villa in St. John's Wood,—while Nero's Golden Palace had triple galleries, each a mile in length. The rich marbles of Egypt and Numidia, the spoils of Grecian Sculpture, and the paintings of Athens and Corinth were reserved for the mansions of the Seven Hills, for Capua, or for Verona.

In general aspect and arrangement, the Pompeian house will remind the Eastern traveller of the houses of Cairo or Damascus. Plain and almost rude without, with few windows and those opening into a narrow street, narrowed that it may be overshadowed, it gives no promise of the splendour within. Opening the door and passing the porter's little cell, you enter a small quadrangle, to be paved with mosaic, with a fountain (and hereafter a statue) in the middle open to the sky and surrounded by the sleeping-rooms, recesses, and various apartments; and passing on through an open room or its side passages, you enter the inner quadrangle, with its garden, also open to the sun and its roof supported by sixteen pillars, and round which are disposed the dining-rooms, baths, and kitchen; and this, rejecting technicalities, is the whole of the ground plan.

It will at once be seen that this house, although unrivalled in interest, can only be taken as one species of Roman habitation, and that not of the richest. In some patrician's houses there were kept 400 slaves, the most trivial daily duty, as in Hindostan, becoming a department in itself. Even in Pompeii many of these houses appear to have had at least one story and terraces above the flat roof of the cloisters below; Juvenal speaks of houses at Rome of ten stories, originating, as in the old town of Edinburgh, from the want of space within the walls, which it was difficult, if not impossible to enlarge.

The walls and ceilings are exquisitely painted, chiefly, as was natural in a place on the shores of the sea, with subjects drawn from the ocean or the mountain. We have no flood of life streaming along the walls, as in a Grecian frieze; no "leaf-fringed legend," as on an Etruscan vase; but, in their stead, flying Cupids, dolphins, sea-bulls, Tritons and sea-Centaurs, with paws branching into sea-weed. In the centre pannel of a recess to the right of the entrance there is a small painting of *Perseus rescuing Andromeda*, a favourite subject at Pompeii. The monster, "a most delicate monster," evidently a small species of shark, lies at the maiden's feet. The background is well chosen, and with much successfully-attempted atmosphere. In one compartment we see a slave bringing a seated bather a flesh-scraper. The style of decoration is light and summary, almost flimsy,—rich blues, deep reds, and black predominate as the grounds. In another

room we have *Venus fishing* and in an adjoining chamber we see Cupid pointing to a maiden (perhaps Dido,) her lover's galley lying in the distance. Round this cornice, alive with azure birds and geese and peacocks, a train of Cupids hurry along with an untied garland that streams behind. Here are a group of winged Loves, carrying between them a wine-jar shaped like a strawberry pottle,—and here is a musical party of the brood of Venus, some seated on couches and others applauding a girl who dances to the sound of a flute, keeping time with castanets. Here is an old man drawing a Cupid from a cage full of his rainbow-winged kinsmen, half butterflies, half seraphs;—and here is Venus driving a *biga* or small car.

The roof above the fountain is supported by Fames or winged angelic figures,—the four above the *tablinum*, or state room, leading to the inner court, being gilt. In this open hall in Roman houses were preserved the statues of deceased ancestors, archives, &c. It served as a sort of state reception-room. In many houses the whole of the fountain court was surrounded by statues. Over this opening coloured awnings were frequently drawn, and in small houses vines were sometimes trained, for air and shade are necessaries of life in a southern climate. Rich hangings supplied the place of doors, except to the chief entrance and the bed-chambers. In this particular truth has been necessarily laid aside for convenience, for two doorways have been introduced in addition to the two which should really exist, and doors will not be put to the bed-chambers where they would only hide the decorations.

The rooms are chiefly lit from the two courts, but the sleeping apartments have two windows of the modern size,—two others are lit from the street (probably also for the sake of the public eye,)—and two others are lit by alcove openings in the ceiling.

Against the wall of the outer court stands, in a niche, like that of an Italian Madonna, the altar of the guardian *Lares*,—deities probably of the Etruscan origin. To these incense was burnt and offerings made on certain days,—and indeed, in the latter ages of a universal scepticism, and with the exception of the worship of Isis, the Puseyism or fashionable religion of the day, these rites constituted almost all the ritual of the rich. In the kitchen we find the same twin deities represented by the figures of two snakes approaching an altar. Emblematical paintings of fruit and silver-gilt drinking cups indicate the dining-room.

In such a villa as is here represented, clad in festive robes of purple and crowned with flowers, Cicero may have sat and boasted of Catiline's flight from the senate house,—or the perfumed Cæsar, with his wounds still fresh from the last campaign, may have eulogized the admirable oysters or sneered at the stupid slaves of Britain. Here may have feasted the men who conquered the world only to live at peace on snails, thrushes, flamingoes' tongues, the brains of nightingales, and the udders of sows. In such places and with such surroundings, feasted those gorgeous diners who, as we are told, had at one dinner alone 2,000 different dishes of fish and 7,000 fowls, and who spent hundreds of pounds on a single made dish. Here voluptuaries may have melted emeralds in vinegar or frothed the rich wine of Lesbos with Arabian ointments. Into such luxurious nooks and corners of the Roman world, men weary of the Imperial capital, with its jostling crowds of vagabond Jews, noisy gladiators, Egyptian jugglers, Spanish dancing-girls, Syrian fortune-tellers, Moorish slaves, and Illyrian litter-bearers, may have retreated for a season of repose: seated or reclining in such luxurious bowers, some of the masters of mankind may have looked up dreamily at the clear blue sky, smiling as the sea-breeze wafted the fragrance of the violets from the inner garden, which crept round them as if Venus herself was passing near unseen, or listened in silence to the unceasing splash of the fountain or the song of the female slave at the loom.

A casual glance will show how easily a city of such houses as these would be destroyed by an eruption. They were, in fact, open bowls, into which the lava could be poured by old Vulcan like a stream of wine.—*Athenæum.*

Dr. Church's Breech-loading Cannon.—A final trial was made on Friday of two cannons that have been prepared to be sent to Woolwich. They were fired 50 times with heavy charges of powder and ball with perfect success. No defect in any respect could be pointed out by the best judges. Upon this plan heavy ship guns can be loaded and fired and brought into position by two men five times in a minute, and a field-piece eight times in a minute. The gun heats very little.—*Birmingham Journal.*

Manufacture of Gold Pens.

The Gold for pens is rolled into thin strips, about the thirty-second part of an inch in thickness. In this state it is black on the surface, and looks like brass. The first operation is cutting it into stubbs—short pieces pointed and angular at one end, and cut square off at the other, this is done in a die; the stubbs are then run through a machine, and each point is indented for the reception of the real pen points. The next operation is pointing the stubbs. The substance used for points is rhodium, a hard brittle metal like steel, unoxidizable. It is to this metal we wish to direct particular attention.

There are various qualities of it, some worth twelve, twenty, thirty, and forty dollars per ounce, and even $120 has been paid for a superior quality. It is found in the ores of platinum associated with irridium, osmiun, and palladium. Irridium is used by some for the points of gold pens, but rhodium is the dearest and best. All of this metal used in the United States comes from the Peruvian or Russian mines, but we have been assured that there is plenty of it in California. It is also found there pure, associated with sands, and requiring no chemical manipulation for its separation, as in the platina ores of the Ural. Our gold seekers in California should direct their attention to this metal, as it is far more valuable than gold. It is of a white glassy steel color, and in minute roundish particles like sand; the round globular particles are the best for pen points; in fact, out of one ounce of this metal perhaps not one-seventieth of the granules can be used, the rest are rejected. A fine particle of rhodium is soldered on the indented point of each stub of gold. The solder is mostly composed of gold, for, unless it is gold, ink soon corrodes it, and the rhodium point soon drops off. This is the case with poor pens made by indifferent makers.

After the pen is pointed, it is rolled between rollers with indents in them to save the points until the stub is drawn out to its proper length and correct thickness. The rolling also makes the gold elastic. Many suppose that gold pens can be re-pointed, but such is not the case, for the heat employed to solder on the point renders the gold as plastic as a piece of tin; the heat changes the relative position of the crystals of the metal—thrusts them out as it were—and the gold requires rolling or hammering afterwards to give it elasticity—the spring so requisite for pens. This is the reason why old pens cannot be re-pointed. Some makers do not hammer their pens after being rolled; they are never so good. After being rolled they are cut to the proper form in a finish die, then stamped with the name of the maker, and afterwards turned up to the rounding quill form. After this the point is slit with a thin copper disc revolving at a great velocity; the great speed makes the soft metal disc cut the hard metal rhodium; the gold is slit with another machine; therefore to make a slit in each pen it has to undergo two operations. The point is next ground on a copper wheel revolving at a great velocity. This is a very delicate operation, and a good artist gets high wages. After this the pens are "stoned out," that is, they are ground down on the inside and out by fine Water of Ayr stones, by hand on a bench alongside of a tub of water, the stones are long, thin, roundish slips, and the pens have to be operated so as to make one part more thin than another, to give them the proper spring. They are then polished on swift revolving copper rollers, and afterwards finished with fine powder and soft chamois skin. Thus, to make a gold pen, it undergoes twelve operations. Inferior pens can be made with less labor, but they soon develope their true characteristics.

The Railways of the World.

The number of miles of railway now in operation upon the surface of the globe is 84,776, of which 16,180 are in the Eastern Hemisphere, and 18,590 are in the Western; and which are distributed as follows:—

	Miles.		Miles.
In the United States......	17,317	In Belgium	532
In the British Provinces.	823	In Russia.....................	422
In the Island of Cuba....	359	In Sweden	75
In Panamá..................	81	In Italy	170
In South America.........	60	In Spain	60
In Great Britain	6,976	In Africa	25
In Germany	5,340	In India........................	100
In France	2,480		

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—January, 1854.

Latitude, 43 *deg.* 39.4 *min. North.* *Longitude*, 79 *deg.* 21. *min. West.* *Elevation above Lake Ontario*, 108 *feet.*

Magnet.	Day.	Barom. at tem. of 32 deg. 6 A.M.	2 P.M.	10 P.M	Mean.	Tem. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y in Miles	Rain in Inch.	Snow in Inch.
						°	°	°	°														
d	1	29.376	29.334	—	—	18.4	25.5	—	—	0.096	0.117	—	—	.92	.82	—	—	W	SWbW	—	5.53	...	0.2
e	2	.501	.699	29.880	29.717	16.5	19.4	14.0	16.00	.083	.080	0.082	0.081	86	74	94	86	W	W b S	W S W	9.48	...	...
b	3	.863	.635	.479	.646	12.3	29.8	24.4	23.88	·068	.154	.123	.120	81	94	92	88	W b S	S E b S	E S E	8.97	...	...
b	4	.443	.452	.664	.535	38.8	45.2	36.8	39.42	.208	.252	.190	.210	89	85	89	86	SW bW	SWbW	N b E	8.65	...	Inap.
a	5	.790	.562	.391	.576	30.5	30.6	41.0	34.35	.148	.154	.242	.183	88	90	95	91	N b E	E S E	E b S	7.02	0.255	Inap.
a	6	.634	.841	.982	.837	28.2	19.8	14.6	20.60	.124	.076	.062	.086	79	79	69	75	N W	N b W	W S W	8.21	...	...
e	7	.903	.747	.715	.785	14.7	18.2	19.5	17.60	.077	.087	.077	.082	86	83	71	81	N b W	W S W	W S W	6.85	...	Inap.
da	8	.648	.656	—	—	18.3	16.4	—	—	.081	.072	—	—	78	74	—	—	W	N b W	—	3.90	...	Inap.
b	9	.666	.691	.668	.659	5.0	20.8	18.8	14.80	.051	.074	.091	.076	85	64	88	88	N	W S W	Calm	5.51	...	0.8
ab	10	.491	.457	.595	.525	25.5	34.0	30.1	29.60	.184	.167	.158	.146	95	86	91	88	S S E	S	Calm	1.78	...	Inap.
c	11	.660	.619	.380	.551	24.8	34.5	35.5	30.75	.115	.168	.199	.156	85	81	96	88	NE b E	NE b E	E N E	6.27	0.485	...
c	12	.002	28.706	28.929	28.889	39.5	41.2	37.2	39.40	.284	.256	.196	.229	97	1.00	89	95	E N E	E N E	W b S	7.54	0.190	...
b	13	.095	28.992	29.177	29.100	34.1	34.1	26.1	30.32	.179	.158	.132	.151	92	79	92	88	W b S	S W	W b S	10.22	...	0.2
b	14	.457	29.656	.806	.668	24.6	27.3	24.5	25.23	.114	.115	.124	.117	84	76	92	84	NW bN	N WbN	W N W	5.72	...	...
b	15	.854	.758	—	—	25.5	28.2	—	—	.119	.101	—	—	85	78	—	—	W	NE b E	—	3.60	0.080	Inap.
c	16	.829	.472	.690	.509	33.0	34.5	28.0	31.78	.171	.175	.116	.156	91	89	75	86	Calm	W N W	W	3.74	...	...
c	17	.730	.803	.619	.833	22.6	27.7	17.6	22.10	.104	.111	.088	.098	84	72	81	76	Calm	W b N	NWbW	4.97	...	0.6
b	18	.858	.782	.929	.857	20.0	20.5	19.8	19,85	.092	.093	.098	.095	82	82	88	85	N E b E	N E	N N E	6.29	...	0.4
c	19	.884	.853	.657	.778	26,0	29,1	26.3	26.90	.128	.142	.130	.133	88	88	89	89	Calm	N N E	NE b E	7.18	...	1.8
c	20	.354	28.998	28.991	.093	25.5	28.9	37.4	30.68	.126	.157	.208	.164	89	98	94	94	E	E S E	W b N	8.87	0.090	...
a	21	.132	29.420	29.711	.444	29.1	14.7	9.0	15.65	.141	.077	.054	.086	88	86	76	83	W	W b S	W b S	15.94	...	1.5
a	22	.928	.974	—	—	5.8	11.5	—	—	.058	.060	—	—	92	78	—	—	W b S	W	—	7.18	...	...
b	23	.888	30.069	30.029	30.001	7.6	5.4	4.7	5.87	058	.044	.047	.048	87	73	81	79	W N W	W	W S W	11.88	...	...
a	24	.791	29.880	30.116	29.949	11.5	14.0	-2.4	6.82	.044	.058	.033	.044	57	67	79	71	W	N W	N E	8.13	...	0.5
a	25	30.213	30.077	29.546	.919	-4.3	13.9	23.8	11.92	.024	.062	.123	.074	62	72	95	77	N E	S E b E	E b S	7.76	...	0.6
a	26	29.265	29.295	.500	.364	30.9	39.6	26.8	32.70	.158	.215	.125	.169	92	89	86	89	S S E	W b N	NWbN	8.03	...	...
a	27	.539	.467	.759	.608	19.7	20.9	12.2	17.47	.094	.097	.059	.082	85	83	78	79	W b S	W b N	N W	8.89	...	0.2
e	28	30.024	30.180	30.176	30.182	0.0	5.2	0.9	1.58	.036	.042	.089	.038	78	71	81	76	Calm	N	N E bN	5.47	...	0.7
c	29	30.089	30.040	—	—	4.3	20.8	—	—	.050	.102	—	—	87	88	—	—	NE b N	E b S	—	5.96	...	Inap.
c	30	29.822	29.610	29.895	29.588	27.0	35.8	35.9	33.18	.130	.154	.194	.164	87	78	92	86	N E	S b W	S W b S	6.33	0.060	...
a	31	.312	.193	29.149	.210	34.8	35.5	35.9	35.47	.187	.186	.189	.189	93	90	90	92	W	S WbW	Calm	2.71	0.110	...
																		Miles.	Miles.	Miles.			
	M	29.602	29.583	29.624	29.607	22.23	26.18	22.94	23.57	0.116	0.129	0.122	0.122	85	82	86	84	6.82	9.15	7.87	6.86	1.270	7.5

Highest Barometer...... 30.219, at 8 a.m. on 25th } Monthly range:
Lowest Barometer ...... 28.693, at 3 p.m. on 12th } 1.526 inches.

Highest temperature.. 46°.4, at p.m. on 4th } Monthly range:
Lowest temperature... –5°.4, at a.m. on 25th } 51°.8.

Mean Maximum Thermometer.............. 29°.31 } Mean daily range:
Mean Minimum Thermometer.............. 13°.53 } 15°.78.

Greatest daily range............... 39°6, from a.m. 25th to a.m. of 26th.

Warmest day ...... 4th. Mean temperature...... 39°.42 } Difference,
Coldest day......... 28th. Mean temperature...... 1°.58 } 37°.84.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1293.42.	2915.87.	921.64.	1116.82.

Mean direction of Wind W b N.

Mean velocity of the Wind... 6.86 miles per hour.

Maximum velocity .... 23.1 miles per hour, from 10 to 11 a.m. on 21st.

Most windy day...... 21st; Mean velocity... 15.94 miles per hour.

Least windy day ..... 10th; Mean velocity... 1.78 ditto.

Raining on 7 days. Raining 39.5 hours.

Snowing on 11 days. Snowing 42.2 hours.

Aurora observed on 3 nights. Possible to see Aurora on 10 nights. Impossible to see Aurora, 21 nights. Solar Halo and Parhelia on the 2nd at 7.45 a.m.

Comparative Table for January.

Year.	Temperature. Mean.	Max. obs'vd.	Min. obs'vd.	Range.	Rain. D's.	Inch.	Snow. D'ys	Inch.	Wind Mean Vel'y.	
	°	°	°	°						
1840	17.0	40.6	—18.8	54.4	4	1.395	11	Not Regis'd.	Not Regis'd.	
1841	25.6	41.7	—4.1	45.8	2	2.150	14			
1842	27.9	45.8	+1.8	44.5	5	2.170	9			
1843	28.7	54.4	+1.5	52.9	6	4.295	12	14.2	0.69	lb.
1844	20.2	44.6	—7.7	52.3	7	3.005	11	24.9	0.70	lb.
1845	26.5	43.0	—3.4	46.4	5	Imp.	9	22.7	0.70	lb.
1846	26.7	41.2	+0.3	40.9	5	2.835	10	6.0	0.55	lb.
1847	23.3	42.6	—2.2	44.8	7	2.185	5	7.5	1.09	lb.
1848	28.7	51.5	—12.0	63.5	7	2.245	8	7.1	5.82	Miles.
1849	18.5	40.1	—15.2	55.3	4	1.175	10	9.2	6.71	Miles.
1850	29.7	46.3	+10.6	35.7	5	1.250	8	5.2	5.80	Miles.
1851	25.5	43.2	—12.8	56.0	4	1.275	10	7.8	7.69	Miles.
1852	18.4	37.3	—7.0	44.3	0	0.000	19	30.9	7.67	Miles.
1853	28.0	40.9	—6.6	47.5	1	0.290	6	7.5	6.34	Miles.
1854	23.6	45.2	—4.3	49.5	7	1.270	11	7.5	6.86	Miles.
									0.75	lb.
M'n.	24.22	43.89	—5.03	48.92	4.6	1.785	10.2	12.54	6.70	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.——January, 1854.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 Feet.

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	Inch.	Inch.	6 A.M.	2 P.M.	10 P.M.
1	29.802	29.505	29.288	11.0	21.0	4.0	.082	.126	.055	.88	.93	.95	N E	N	N W	7.50	0.87	0.22		0.21	Str. 8.	Slight Snow.	Clear.
2	.820	.860	.589	12.4	24.0	19.0	085	121	117	88	80	94	N W	W S W	W b S	0.05	5.12	6.24		Inapp	Light Snow.	Cum. Str. 4.	Snow.
3	.720	.627	.530	14.3	26.2	19.8	091	141	114	87	88	87	W b S	S b W	S E b E	7.70	0.93	2.22		1.10	Cir. Cum. Str.	Do. 10.	Clear.
4	.819	.250	.279	19.0	44.5	42.1	117	292	283	94	94	92	N E	W S W	S W b W	8.10	0.41	10.63			Cir. Str. 8. [8.	Cir. Str. 8.	Cir. Str. 8.
5	.620	.540	.446	29.2	20.8	12.6	161	101	083	89	77	82	N N W	N E b E	N E b E	11.26	6.25	14.02			Do. .8.	Str. 10.	Sleet.
6	.297	.437	.671	18.0	19.8	5.0	101	117	053	83	94	85	W	W N W	N W	15.05	12.03	14.40			Sleet.	Cir. Str. 2.	Clear.
7	.667	.558	.490	2.2	21.2	14.5	051	081	097	95	60	98	N W	W S W	S W	6.80	3.12	2.01			Cir. 3.	Clear.	Cir. 4. [40 am
8	.476	29.415	.489	10.9	12.9	–1.0	079	068	088	88	67	88	W b N	N W	N W	4.12	5.00	8.87			Clear.	Do.	Clear A. Bo. 2.
9	.501	.571	.570	–18.0	–1.0	–11.5	019	043	021	63	84	75	N W	N W b W	N W b W	3.00	2.40	1.55			Do.	Do. [at 6 p.m.	Cum. Cir. Str.
10	.519	.530	.587	–9.5	–4.0	1.0	024	033	043	78	83	84	N E b E	N E	N E	8.68	8.91	11.15		2.90	Snow at 5 a.m.	Snow ceased	Cir. Str. 8. [8.
11	.680	.647	.602	8.1	14.1	14.2	048	086	097	84	82	98	N E b E	N E b E	N E b E	11.43	6.19	5.14	0.957		Clear.	Clear.	Rain at 9.15 p.
12	.170	28.850	28.540	32.5	34.0	44.5	199	210	312	98	99	99	N E b E	N E b E	S E b S	11.80	6.25	4.06	0.110		Rain.	Rain.	Cir. Str. 9. [m.
13	28.890	28.850	28.883	37.0	36.1	33.0	221	218	197	95	95	94	S W b W	W S W	W S W	6.88	36.26	9.15		Inapp	Cir. Str. 9.	Cir. Str. 8.	Slight Snow.
14	29.182	29.389	29.878	18.1	18.5	10.0	099	080	075	82	78	84	N W b W	W	W	13.88	15.55	1.02			Do. 8.	Do. 4. [p.m.	Cir. Str. 4.
15	.787	.676	.671	0.5	6.5	4.0	042	052	051	89	79	85	N W b W	N E b E	N E b E	5.52	2.28	3.16		0.84	Clear.	Snow at 1.45	Snow.
16	.204	.580	.875	5.5	17.0	21.0	058	088	126	92	85	93	N N E	N W	W b N	16.75	4.12	2.26		3.07	Snow.	Str. 10.	Str. 10.
17	.489	.486	.665	–18.0	21.0	9.1	106	104	060	87	78	80	W b N	W N W	W	4.41	12.81	1.64			Cir. Str.	Cir. Cum. 2.	Clear.
18	.807	.725	.771	–2.4	7.7	5.4	086	056	058	84	80	92	W b N	N E b E	N E b N	4.50	0.20	4.98			Str. 8.	Str. 9.	Do.
19	.759	.578	.619	–2.1	12.6	6.5	041	077	059	96	78	92	N E b E	N W b N	S W b W	1.17	0.40	0.48			Do. 10.	Do. 8.	Cir. Str. 4.
20	.525	.178	28.893	7.5	12.3	11.7	062	078	086	98	93	90	N E b E	N E b E	N E b E	8.22	12.47	4.14		5.06	Snow at 5 a.m.	Snow.	Do. 9.
21	28.945	29.000	29.304	16.1	18.0	0.0	098	093	048	88	79	80	W b S	W b S	W N W	8.86	4.24	15.97			Cir. Str. 4.	Cum. Str. 4.	Clear.
22	29.734	.748	.779	–15.2	2.0	–7.5	014	042	028	58	76	80	W	W	S W b S	13.84	5.53	2.12			Clear.	Clear.	Do. [realis.
23	.541	.687	.786	–6.5	6.3	–9.1	036	059	024	90	92	76	N E b E	W S W	W S W	13.87	12.09	6.85		0.40	Snow.	Snow.	Clear A. Bo-
24	.507	.453	.821	5.1	12.5	–10.9	058	071	023	85	82	77	S S W	W	N W b W	6.58	6.80	21.29		1.60	Do.	Cir. Cum. 4.	Clear.
25	30.054	30.059	.914	–25.1	–2.5	–15.1	011	034	019	73	73	83	N W b W	S W b S	E b S	8.62	2.22	0.62			Clear.	Clear.	Do.
26	29.332	29.139	.226	–8.2	4.1	6.0	033	050	058	90	92	92	N E b E	N E b N	W b N	15.06	8.00	1.15		2.90	Snow.	Snow.	Clear.
27	.359	.281	.409	5.4	14.0	2.0	058	080	050	92	78	86	W S W	W N W	W N W	11.81	8.39	1,75			Clear.	Clear.	Do. [lis.
28	.784	.892	.912	–12.0	–5.2	–16.0	024	030	018	80	80	82	W N W	W N W	W	8.25	15.00	4.82			Do.	Do.	Do. A. Borea-
29	30.024	.948	30.082	–34.3	–3.7	–19.8	005	032	016	55	70	80	W	N b E	N b E	Calm	0.12	0.26			Do.	Do.	Do. do.
30	29.884	29.646	29.459	–11.5	2.1	6.6	021	046	060	75	84	84	N E b E	N E	N E	7.00	5.62	3.00		0.40	Str. 10.	Snow.	Str. 10.
31	.152	.196	28.949	29.0	36.0	33.5	161	210	204	89	91	94	S	W S W	S S W	3.68	3.00	4.91			Sleet.	Str. 10.	Sleet.

Barometer ... { Highest, the 25th day 30.059
Lowest, the 12th day 28.540
Monthly Mean 29.516
„ Range 1.519

Thermometer. { Highest, the 12th day .... 44°.5
Lowest, the 29th day .... –34°.3
Monthly Mean .... 10°.92
„ Range .... 78°.8

Greatest Intensity of the Sun's Rays .... 123°.0
Mean Humidity .... .848

Rain fell in 2 days amounting to 1.067 inches.
Snow fell on 12 days amounting to 17.98 inches.
Aurora Borealis visible on 4 nights. Might have been seen on 11 nights.
Most prevalent Wind N E b E.
Least do. do. S.
Most Windy Day, the 6th day; Mean miles per hour, 13.82.
Least Windy Day, the 29th day; Mean miles per hour, 0.12.
The Electrical State of the Atmosphere has been marked *generally* by a Moderate Intensity of a Positive character.
The Mean Temperature of the Month is 5°.76 below that of last January.

Monthly Meteorological Register, Quebec, Canada East.—January, 1854.

BY LIEUT. A. NOBLE, R.A.

Latitude, 46 *deg.* 49.2 *min. North; Longitude,* 71 *deg.* 16 *min. West. Elevation above the level of the Sea, — Feet.*

Date.	Barometer corrected and reduced to 32 degree, Fahr.				Temperature of Air.				Elasticity of Air.				Humidity of Air.				Direction of Wind.			Velocity of Miles.				Rain in inch.	Snow in inch.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	6 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	M'N.		
					°	°	°	°																	
1	29.748	29.542	29.496	29.595	16.0	23.5	21.0	20.2	.081	.107	.111	.080	.86	.82	.96	.88	E S E	E S E	Calm	12.4	10.9	...	7.8	...	3.5
2	.544	.587	.584	.572	18.3	26.5	17.5	20.7	100	127	095	107	96	86	94	92	W N W	W N W	W N W	3.8	6.2	6.2	5.4	...	1.5
3	.970	.992	.898	.953	15.4	20.0	17.5	17.6	083	097	082	087	89	87	80	85	W S W	W S W	W S W	6.2	5.2	...	3.8	...	...
4	.591	.432	.485	.486	23.5	33.8	41.0	32.7	117	157	188	159	91	80	72	81	W b S	W b S	W	3.8	6.2	11.3	7.1	...	...
5	.829	.989	.866	.895	23.5	21.5	15.0	20.0	104	090	070	079	80	76	77	77	N W	W N W	E b S	8.0	6.2	13.4	9.2	...	3.8
6	.482	.580	.870	.627	16.4	22.2	-1.0	12.5	091	105	041	088	93	86	91	90	E b S	W b N	W N W	14.3	8.8	8.0	10.3	...	0.2
7	.914	.847	.791	.851	-5.0	7.7	5.8	2.8	027	053	054	045	72	79	87	79	N N W	W N W	W N W	12.4	10.1	6.2	9.6	...	1.0
8	.799	.548	.683	.676	6.0	15.2	0.0	7.1	059	082	084	058	92	89	70	84	W b N	W b N	W b S	7.2	8.8	6.2	7.4	...	...
9	.684	.808	.953	.815	-7.4	-7.0	-14.5	-9.6	027	027	016	023	79	80	69	76	W N W	W N W	W N W	6.2	6.2	3.8	5.4	...	...
10	30.054	.979	30.020	30.018	-21.4	0.0	0.0	-7.1	008	044	045	032	50	93	95	79	W N W	E N E	E N E	3.8	3.8	3.8	3.8	...	1.5
11	.123	30.073	30.075	.090	9.0	13.4	17.5	13.3	065	067	080	071	93	79	79	84	E N E	E N E	E N E	8.8	10.1	13.9	10.9	...	4.0
12	29.622	29.877	28.892	29.297	22.0	26.0	30.8	26.1	106	138	164	136	87	97	97	94	E N E	E N E	E N E	27.8	34.1	30.1	30.6	...	3.0
13	.028	.045	29.051	.041	33.7	37.3	34.5	35.2	182	184	148	173	95	82	72	83	N N W	W b S	W b S	10.1	8.0	5.2	7.8	...	1.0
14	.077	.460	.812	.449	29.8	17.5	7.0	18.1	140	084	054	096	84	83	83	83	W S W	W b S	W b S	8.0	10.1	8.0	8.7	...	...
15	30.026	30.111	30.108	30.082	-3.2	7.0	5.5	3.1	032	053	044	050	78	81	73	77	W b S	W b S	W b S	8.0	5.2	5.2	6.1	...	1.0
16	29.825	29.545	29.665	29.678	6.3	8.3	11.5	8.7	060	064	061	062	94	95	78	89	E b N	E b N	W b S	25.4	22.7	13.9	20.6	...	3.0
17	.688	.702	.911	.767	15.3	22.8	11.8	16.5	086	106	068	085	93	84	80	86	W b S	W S W	W	9.4	8.0	10.1	9.2	...	...
18	.945	30.117	30.126	30.063	0.0	6.0	4.6	3.5	035	050	042	042	75	80	73	76	W	W	Calm	6.2	6.2	...	4.1	...	...
19	30.001	29.937	.106	.015	-5.2	11.3	4.5	3.5	088	068	058	051	90	86	90	89	Calm	W b S	E N E	...	3.8	8.0	3.9	...	1.5
20	29.940	.707	29.465	29.704	7.5	8.5	7.5	7.8	057	064	061	061	87	93	92	91	E N E	E b N	E	16.0	22.7	21.2	20.0	...	3.5
21	.176	.187	.811	.208	11.0	21.5	7.5	13.3	070	102	052	075	93	85	79	86	E	S W	W	8.0	8.0	11.3	9.1	...	3.0
22	.864	30.035	30.103	30.000	-16.0	-7.5	-12.6	-12.0	006	023	018	016	26	61	67	48	W	W	W	13.9	11.3	8.0	11.0	...	...
23	.995	29.920	.066	29.994	-11.5	1.5	-6.5	-5.5	026	034	028	029	93	66	80	80	E	E N E	E N E	8.0	8.8	6.2	7.6	...	...
24	.928	.676	29.984	.863	-12.5	-7.2	-7.0	-8.9	017	020	029	022	61	57	84	67	W b S	W b S	W	5.2	3.8	3.8	4.2	...	...
25	30.378	30.415	30.374	30.389	-21.5	-11.5	-16.5	-18.2	005	019	010	011	24	68	47	45	W	W	W	8.8	6.2	5.2	6.7	...	1.0
26	29.816	29.461	29.418	29.565	-2.5	3.5	6.5	2.5	028	038	055	040	65	68	87	74	E b S	E b S	E b S	10.1	8.0	6.2	8.1	...	5.0
27	.519	.532	.594	.548	5.6	15.5	0.0	7.0	047	063	035	048	78	67	76	74	E	W	W	10.1	8.0	5.8	8.1	...	...
28	.886	30.060	30.294	30.080	-15.7	-3.0	-15.4	-11.4	013	028	016	019	62	66	75	68	W	W N W	W N W	10.1	8.0	3.8	7.3	...	...
29	30.383	.420	.440	.414	-26.8	-7.8	-14.2	-16.1	009	020	012	014	70	57	49	59	N N W	W N W	W N W	6.2	6.2	6.2	6.2	...	...
30	.254	.052	29.805	.037	-22.7	5.4	13.5	-1.3	008	044	065	039	48	73	76	66	W N W	W	W	6.2	3.8	3.8	4.6	...	...
31	29.508	29.304	.220	29.342	28.5	32.4	31.2	29.0	112	164	148	141	86	90	84	87	W	W	W	3.8	6.2	5.2	5.0	...	4.0
M	29.793	29.799	29.787	29.776	3.5	11.7	7.2	7.5	0.056	0.075	0.068	0.064	78	79	79	79				9.8	9.1	7.7	8.7		41.5

REMARKS.

2nd. Aurora appeared at ¼ to 7 p.m. Was obscured by the clouds at about 10 p.m. Very faint. Luminous circle and dark arch underneath.

4th. A faint light visible in the north at 2 a.m.

5th. Very hazy.

8th. Aurora visible at 5¼ p.m. Not visible at 6 p.m. Visible again at 8½ p.m. Commenced to snow at 11 p.m. Aurora again visible at 2¼ a.m.

9th. No Aurora.

12th. Very stormy.

16th. A very dark cloud visible in the north, extending from N.N.W. to N.E. A light shining through the clouds above it.

18th. Lunar halo at 12½ a.m., 50° in diameter. Not possible to see Aurora till 1 a.m. Aurora not visible at that time.

Highest Barometer, at 10 p.m. on the 29th.............. 30·440 } Monthly Range, 1·548 in.
Lowest Barometer, at 10 p.m. on the 12th.............. 28·892 }

Maximum Thermometer.. 43°·0 } Monthly Range, 72°·0
Minimum Thermometer.. -29°·0 }

Mean Maximum Thermometer.............................. 15°·1 } Mean Daily Range, 17°·8.
Mean Minimum Thermometer.............................. -2°·7 }

Greatest Daily Range, on the 30th....... .... 46°·5
Least Daily Range, on the 20th.. .... 3°·5

Warmest Day, the 4th.. 32°·7 } Climatic Difference, 48°·8.
Coldest Day, the 29th.. -16°·1 }

Possible to see Aurora on 14 nights.
Aurora observed on 9 nights.

SUPPLEMENT
TO THE
CANADIAN JOURNAL
FOR MARCH, 1854.

The Importance of Scientific Studies to Practical Men.

A Lecture delivered before the Members of the Peterboro' Library Association, by John Langton, Esq., M.P.P.

LADIES AND GENTLEMEN:—

I have been most anxious that the Library Association, which we have been forming in this town, should also embrace a Mechanics' Institute; because, although a collection of books is an essential part of such an institution, a Library alone does not meet all the objects which I am desirous of promoting. A Public Library is designed to develope a taste for reading, and to afford facilities for the cultivation of literature generally, without a special preference for any particular department: a Mechanics' Institute, on the contrary, may in one sense be said to have a more confined object, being chiefly intended to promote the study of the Physical Sciences; but in other respects it embraces a larger field, by enabling its members to prosecute those studies, not from books alone, but by the gradual accumulation of a museum of philosophical apparatus, and more especially by means of the delivery of Lectures. This being the end which I have been endeavoring to attain, I have been induced, with some other gentlemen holding similar views, to make a commencement with a short series of lectures; and keeping in mind that, which has been my leading object from the first, I have selected for the subject of the present discourse, the *Importance of Scientific Studies to Practical Men.*

It would be a waste of time, and almost an insult to your understandings, to enter into a formal defence of the uses and advantages of scientific knowledge. No such pleading can be required in the middle of the nineteenth century, when the last fifty years have witnessed a crowd of brilliant discoveries which have no parallel in history, except in the equally astonishing intellectual activity which distinguished the seventeenth century. But there are even now prejudices upon the subject, though of a very different kind from those which the first fathers of science had to combat, and which may deserve a word of comment. Within little more than fifty years from the dawn of modern science, the only true method of studying Nature was fully and firmly established, and the foundation of most of the sciences was securely laid. The actual knowledge gained was mostly that of correct theory, and the opposition came from the learned, who had to forget their old doctrines and to begin anew. The practical men hardly meddled at all in the disputes, or were on the side of the new discoveries. Now, on the other hand, the characteristic of the age is the practical application of our knowledge to purposes of immediate and obvious utility; and yet, curiously enough, it is from the practical men that the murmurs are chiefly heard.

One cause of this is, undoubtedly, the difficulty arising from the language of science, and the long and hard names which abound in scientific books. The very appearance of them repels the student, and he is apt to think that, were it not for the pride of learning, they might as well be translated into his native tongue. The difficulty is, however, in a great measure unavoidable. Every trade and craft has its own peculiar technical terms, which are equally unintelligible to the bulk of society. A new fact, a new substance, a new system of classification must have its appropriate name. If you bestow upon it one already in use, and employed to designate something else, instead of rendering yourself more intelligible, you only create confusion. Every accession to our knowledge necessarily requires an addition to our vocabulary, and as science is for all nations, the new names are generally taken from those ancient languages which we have all equally inherited. *Carbon*, for instance, is taken from the Latin word for charcoal, and the chemist uses it as a name for that substance of which, with some trifling impurities, charcoal consists. If you translate it, and call it charcoal, it might seem more intelligible, but would really only lead you astray; for charcoal is only one of the forms in which we know carbon. It exists in almost equal purity in coke and in black lead (into the composition of which, by the way, not a particle of lead really enters), and in an absolutely pure state in the diamond. The element carbon is a new idea, and must have a new name. You cannot say, with truth, that a diamond consists of charcoal or of black lead, but all three consist of carbon. This new nomenclature may be, and is, perhaps, sometimes carried too far, and in such cases, everything that tends to give science an air of unnecessary profundity and obscurity should undoubtedly be amended. But, after all, the difficulty is not so formidable as it may appear, and at any rate it is a necessary evil; for you can no more speak of a science without using its language, than I could converse with a millwright about a saw-mill, without talking of "pitmen," "noddle-pins," "cross-heads," and "dogs," or with a sailor, without using such words as "shrouds," "dead-eyes," and "fids."

A more formidable prejudice is a sort of contempt which practical men sometimes entertain for theory. It is very common to hear a person spoken of as a theorist, in whom you cannot repose the same confidence as in a practical man; but we should not forget that a true theory is, as it were, only the essence of practice, or the generalization of a number of facts. And we cannot close our eyes to the numerous instances in which the greatest improvements in practice have originated in theory. Let us take an instance. There is, perhaps, no class more slow to yield an old prejudice than a sailor. Now it has been known, theoretically, for more than two centuries, that, to obtain the greatest advantage from the wind, a sail should exactly divide the angle between the direction of the wind and the ship's course; and it cannot do this unless the sail sits perfectly flat. If the sail forms a curve, only a part of it can be in the required position, and all the rest must be doing nearly as much harm as good. This was all known, but it was considered only theory, and sailmakers insisted that experience had shown that sails must be made to belly out, to catch, they said, and hold the wind. For two hundred years, practice would not listen to theory, till only the other day the prejudice was so far overcome, that the sails of a yacht were made as flat as canvass could be made to lie, and the consequence was, that the America walked away from all her competitors. Old sailors will no doubt still shake their heads, but in the next generation a "bellying" sail will only be a poetical expression. Theory and practice, in truth, mutually assist each other. They are allies, not rivals; or you may liken them to a general and his soldiers. There were, doubtless, many men at Waterloo who could handle their bayonets, and go through their evolutions better than the Duke could have done; but they could no more have gained the battle of Waterloo without him to direct and combine, than he could have withstood a charge of the enemy without their collective strength.

One other objection to scientific studies I will mention, which always has been, and still is too common, especially among practical men. Where there is an obvious and direct application of some scientific truth or inquiry, the importance of the subject is willingly admitted; but where there appears no immediate prospect of turning it to account, the question is too often asked, What is the use of it? The objection is, in fact, more common now than formerly; for we have been so much accustomed of late years to witness the daily improvements in almost all arts and manufactures, that we are apt to undervalue everything that does not at once come up to our standard of utility. It cannot, however, be too thoroughly impressed upon a student, that no knowledge is without some use. As we say in common life, keep a thing for seven years, and you will find some purpose for it, so in science, a truth once ascertained is an accession to our knowledge, the importance of which can never be known till you can view it in connection with all around it. An anecdote is told of a celebrated sculptor whom a friend visited after the lapse of several days, and found still working at a statue that had appeared almost finished before. The friend wondered what he could have been doing, and the sculptor pointed out that he had scraped a little here and filed a little there, and brought out some feature more prominently in another place. "But these are only trifles," said his friend. "True," replied the sculptor; "but such trifles make the work perfect, and perfection is no trifle." So in science, a fact known is a stone prepared for the temple of knowledge; it may appear unimportant, and it may be idle for years, but time will assuredly show its proper place in the structure, and it *may* prove to be the keystone of an arch.

For instance, more than two thousand years ago the Greek geometricians made a study of that particular class of curves which, because they may be obtained by cutting a cone across in different directions, are called conic sections. In those days there was an exactly opposite prejudice from that which prevails at present, and it was thought rather derogatory to the dignity of science to be mixed up with every day life. They studied these curves, therefore, merely as an intellectual exercise, and for two thousand years conic sections continued to be taught as one of the acknowledged branches of pure geometry, without any attempt at a practical application. But the acquaintance already gained with the curious properties of these curves enabled Kepler, when the state

of astronomical observation was otherwise sufficiently advanced, to recognise the fact that all the heavenly bodies move in conic sections, of which discovery Newton's law of universal gravitation, with all its important consequences, was the immediate offspring.

There are hundreds of similar facts to be met with in the history of science. Yet people still continue to laugh at the apparently trifling and useless researches of philosophers! As Swift, in the voyage to Laputa, satirized the contemporaries of Newton, Peter Pindar quizzed those of Watt. Hook's pendulum experiments, in which the measure of the earth originated, were ridiculed under the name of swing-swangs, and Boyle's observations on the elasticity of air, one of the steps towards the steam engine, were the objects of contemptuous sneers. The steam engine itself, the mighty power of the nineteenth century, was, in its first germs, little better than a scientific toy. What, indeed, could appear more useless than experiments consisting of rubbing pieces of amber, or sealing wax, or glass, and remarking the manner in which they attract little straws, or bits of paper? Yet in these the science of electricity took its rise. Even when Franklin had to some extent advanced the study, his practical countrymen thought it but learned trifling, and asked, "What is the use of it?" Franklin answered, "What is the use of a new-born baby?" When we look at the electric telegraph extending its wires all over the globe, and the countless applications of electricity to almost every branch of science and art, we may well exclaim that that baby has, in less than a century, expanded into a full-grown man, whose use no one would dare to question.

The whole history of science abounds in instances of great discoveries founded upon the simplest observations, and mighty effects resulting from unimportant properties of matter. Franklin had the true spirit of an inductive philosopher; he was always inquiring into something or other. In a voyage across the Atlantic he was engaged, as usual, in trying experiments, and, having no other present field of inquiry, he kept dipping his thermometer into the sea as he proceeded. I dare say the sailors and his fellow passengers laughed secretly at the philosopher, but these experiments resulted in ascertaining the fact, that the different ocean currents have very different temperatures, the great Gulf stream being as much as 12° higher than the surrounding ocean, and the thermometer is consequently now a most useful instrument in helping the mariner to shape his proper course.

A soap-boiler finds a peculiar corrosion in his boilers, and applies to a chemist for an explanation. The chemist analyzes the refuse formed by the corrosion, and discovers a new substance, which, from its violet colour, he calls iodine, after a Greek word. He argues, that it must have come there in some of the substances employed by the soap-boiler, and finds it in the alkali which was used. He next traces it in the marine plants from the ashes of which the alkali was extracted, and finally he discovers it in sea water, and almost all marine substances, amongst which are sponges. A physician now remembers that burnt sponge has long been a popular remedy for goitre (a swelling of the neck, accompanied, in the worst cases, by a peculiar form of idiocy, which is a common complaint in Switzerland, and other mountainous countries), and he tries the effect of pure iodine. The consequence is the discovery of an almost certain cure for this most distressing and heretofore nearly intractable disorder.

Antimony is a metal long known, and abundant enough in nature, though of very limited use in the arts; but it has a peculiar property, which might easily escape notice, without a knowledge of which the art of printing would never have attained its present perfection. You know that all substances expand with heat and contract with cold; but this general rule has a very few partial exceptions. The most conspicuous one is water, which follows the general rule in the shape of steam, and as water it continues to follow it till cooled down to 39½° of the thermometer. Beyond that point, every additional degree of cold expands the water instead of contracting it, till, having experienced another sudden expansion in the act of freezing, it continues ever after, in the form of ice, to contract with cold and expand with heat like other bodies. The consequences to us of this exception are most important; for, were it otherwise, water would begin freezing at the bottom, and not on the surface, and no summer's sun could penetrate to thaw the ice once formed: every piece of water would become a solid lump of ice, and the earth would be uninhabitable. It is not, however, of water that I would speak, but of antimony, which is another partial exception, increasing in dimensions like water in the act of becoming solid from a melted state. Now, the types used in printing must be cast: to form them by carving or punching would make printing almost as expensive as writing; but if cast in any ordinary metal, the fine lines of the mould would not be copied, and the impression would be coarse and indistinct. The addition of a little antimony to the lead, of which types are principally formed, makes the whole expand as it becomes solid, sufficiently to force the metal into the sharpest indentations of the die.

But it is said by some that you may leave such studies to the professionally learned, and that working men have no time for them; or if the nature of their occupation requires some knowledge of scientific results, it is sufficient for the mechanic to know the facts, and to work upon the rules which the philosophers have laid down for him. It has even been contended that the true principle of division of labour requires that the philosopher should devote himself to perfecting theory, and that the practical mechanic should confine his attention to attaining mere manual dexterity. To a certain extent this division must necessarily prevail, but if we are to look for much improvement in our present process, or much advance in our actual knowledge, the two branches must also be in a great measure combined. Theory and practice, as I have said before, mutually aid each other, and the mechanic cannot hope to attain much eminence without some theoretical knowledge, whilst the theorist must not disdain the aid of practical experience. The working mechanic, it is true, can but rarely become an accomplished philosopher, but he can, at any rate, become familiar with the principles of those sciences more immediately connected with his pursuits; and such is the mutual dependence of all the sciences, that he should at least have some idea of the general bearing and extent of our whole physical knowledge. A mere acquaintance with rules is not enough; for a man can never thoroughly understand, or even remember a rule, unless he knows something of the reason of it, and if he comes to apply it under slightly altered circumstances, he can never be certain that it continues to hold good for the case he has in hand. How many persons have wasted great mechanical ingenuity in attempting perpetual motion, which a slight acquaintance with first principles would have shown to be impossible! How many thousands have been thrown away in sinking shafts for coal, in strata which any geologist knew beforehand could contain none, or in working imaginary gold mines for what a mineralogist would, at a glance, have pronounced to be only mica! Again: if the object sought is possible, science will guide you in ascertaining whether the means used are sufficient for the purpose, or are the easiest, and most direct and economical, which can be employed. But more than all, theory will often suggest, and invite to a new track, which never would have occurred to a person unacquainted with science. In a word, if you are content to go on doing what preceding generations have done, you may perhaps trust to experience and rules alone; but if you wish to attempt anything new, where you can have no guidance from experience or rule, you must recur to first principles, which it is the province of science to teach.

Human nature is so prone to cavil, and it is so true a saying, that a prophet has no honor in his own country, that I can imagine some of my hearers may say (or if they do not like to say it openly, may secretly think) that this would be all very well, if any of us were likely to make new discoveries, or hit upon great inventions, but that it is so improbable that the mechanics of a small village like Peterborough should be going so to distinguish themselves, that it is hardly worth while to make preparation for it. Perhaps we may have no undiscovered geniuses amongst us; but (not to mention that already one of our fellow-townsmen has produced an invention, not yet thoroughly tested, but which is now engaging the attention of persons in England, able and willing to give it a fair trial) we never can know whether we have them or not till it is proved by the event. Hundreds of inventions have been made by simple mechanics, having no greater advantages than many of you, whose achievements would tempt me to lay before you some examples, were we not promised a lecture upon this subject by my friend, Mr. Gemley. But not to mention names of such world-wide reputation as Franklin, Watt, Arkwright, Godfrey, Dolland, Stephenson, consider the numbers who, as improvers rather than inventors, are daily benefiting mankind, and laying the foundation of their own fortunes, without their names ever becoming known to fame. If there is only one of you, or one of your children, who has within him the hitherto undiscovered talent to contribute something new to science or to art, we should be sufficiently rewarded for all our exertions to enable him to acquire that knowledge, without which no opportunity, no ingenuity, no natural talent can be of any avail.

But if no practical mechanic can take full advantage of all the circumstances in which he is placed unless he have also some theoretical knowledge, neither can a mere theorist ever effect much who has not sufficient practical experience to know in what direction there is the greatest room for improvement, and what are the existing means for carrying it into effect. Almost all great discoveries and inventions have been made by men who united theoretical to practical knowledge.

Watt was not only a skilful mechanic, but thoroughly conversant with most of the sciences; and in our own time Scott Russell, who, by a series of beautiful and most ingenious experiments, was the first to demonstrate the true form of vessels offering the least resistance to the water, has become himself an eminent shipbuilder. Even in these branches of study which are in themselves of a less practical character, the assistance of instruments, and various complicated mechanical contrivances, is constantly required, and the investigator must be able to devise and direct, even if he does not himself actually construct them. The ingenious instruments invented by the late Dr. Wollaston, and by Professor Wheatstone, are instances of this union in a high degree of mechanical skill and theoretical acuteness. Newton made with his own hands most of the instruments with which his delicate optical experiments were conducted, and he invented, and himself constructed, the kind of reflecting telescope which bears his name; and after him Herschel and Lord Rosse manufactured themselves those great instruments which have given us a new insight into the heavens.

In these remarks I do not merely confine myself to advocating a scientific training for mechanics, as a means of enabling them to pursue their several callings with greater success; I go a step farther, and recommend it for the sake of science itself. With similar advantages of scientific acquirements, a working mechanic is *more* likely than any other person to strike out something new and useful in practice, or something important in principle. He has the best opportunities of perceiving what is deficient in the existing state of his art, and what is the chief difficulty to be overcome. He is daily handling the tools and materials of his trade, and assisting in processes and operations upon a scale and under circumstances which the experimenter in his cabinet cannot imitate. Indications of the secrets of nature are constantly passing under his eyes of which the mere philosopher can know nothing. Yet all these advantages must be barren and useless, unless some knowledge of principles and a habit of generalizing enable him to seize the hint, and turn it to account. The seed is being liberally scattered, but unless the soil is prepared for its reception, it will bring forth no fruit.

It is not often that we know with any certainty the whole history of a new discovery, but when we do, we very generally find that it originated in a trifling indication such as I have spoken of, which hundreds of people had seen before, without thinking it worthy of attention. Even when the discovery is the result of a laborious investigation for that especial object, the original inducement to commence the inquiry has often been some casual observation, or the final course of reasoning which has led to its success has been dictated by an accident, which has caused the whole mystery to flash across the mind in an instant. Such discoveries are frequently spoken of as accidental, and if they are so, such chances are *more* likely to occur to practical men than to any others; but to call them accidents has a tendency to mislead, and at any rate does not tell the whole truth. Such chances occur daily to us all, but it is only the favored few that can take advantage of them. When a man's mind is deeply intent upon some particular subject, a mere trifle may often give it an impulse which leads to a new view of the question, and ultimately to a new discovery; but the bent of the mind must already exist, and the capacity to turn the new idea to advantage.

It may be interesting to illustrate this by some examples.

The story of Archimedes is well known. Hiero, King of Syracuse, had given a certain weight of gold to a jeweller, from which to manufacture a crown; and when the crown was brought to him, and found to be of full weight, he still wanted to know whether it was all really gold, or whether the weight had been made up with baser metal, and he consulted Archimedes. The question, evidently, was to determine whether the *bulk* of the manufactured crown was the same as that of the gold given out; for, if it were no greater, gold being the heaviest metal then known, it would be clear that it must be all pure gold. Whilst meditating upon this commission, Archimedes went into a bath, and noticed how his body, by displacing a quantity of water equal to its bulk, raised the level of the whole, as if a similar amount of water had been added. The whole secret was seen through in a moment, and he is said to have jumped out of the bath, and to have run home, forgetting even to dress himself, and exclaiming, as he went, that he had found it out. This is a fair specimen of these accidental discoveries. Thousands had seen the water rise in a bath before, but it was only to a man of the attainments of Archimedes—and he, too, in search of the hint he found—that the accident gave rise to the discovery of the hydrostatic balance, of specific gravities, and the whole theory of floating bodies.

It was more purely an accident when Hauy dropped a beautiful crystal, which he was examining, on a marble floor, and, on gathering up the fragments into which it was shivered, discovered that crystals have planes of cleavage differing from their outward forms, and thus created an entire change in that branch of mineralogy. Substances which crystalize, always assume certain definite forms by which they may generally be recognized; but most crystals are subject to great modifications of figure, and some so much so, that they lose even a general resemblance to their usual characteristics. Thus, suppose a common brick to be the primary form in which a substance crystalizes: as fresh additions are made, the whole mass may still keep the shape of the first brick; but from the same materials you may also build up a square tower, or a pyramid. The outward form does not, therefore, necessarily exhibit the interior arrangement of the separate parts; but if you can obtain planes of cleavage, which show the courses of masonry, and the direction of the joints, you can detect the original brick, whether in the pyramid or the tower. This was the nature of Hauy's discovery, arising from a mere accident; but the occurrence would have been fruitless to any but an accomplished mineralogist, who had already directed his attention to the forms of crystalization.

Again: it was by accident that a French officer of engineers, named Malus, was looking at the reflection of the setting sun on the windows of the Luxemburg Palace, through a plate of doubly-refracting crystal, called tourmaline, when he remarked that one of the images disappeared on turning the crystal round. Hundreds might have seen the same thing, but it was only in the case of one already engaged in the study of optical phenomena that the observation gave rise to a most singular and important discovery, that, when reflected or refracted in a certain manner, light attains an entirely new property, and ever after refuses to be reflected or refracted except in certain directions. Light thus modified in its nature, so as to have a definite relation to space, and to affect certain directions in preference to others, is said to be polarized, from a sort of analogy with the magnetic needle, whereas common light traverses transparent bodies in any direction, being only reflected or refracted at their surfaces. When thus changed in character, it meets with somewhat similar obstructions in their interior, giving rise to some most singular and splendid displays of colour, and, what is more important, giving us a deeper insight into the internal constitution of matter than was ever attained before, and we are apparently as yet only on the threshold of the discoveries it may lay open to us.

It is related of Galileo, that, whilst attending divine service in the cathedral at Pisa, he noticed that a chandelier, which had in some way been disturbed, continued to swing in exactly equal intervals of time. No accurate measure of time was known in those days, so he tested the quality of the vibrations by his own pulse. As he was at that time studying for the medical profession, he employed his discovery in a little instrument for counting the pulse of his patients. Afterwards, when he deserted medicine for the physical sciences, he founded upon it many of his new, but just views of the laws of motion; and in later life, when he became an astronomer, the same accidental observation supplied him with the pendulum for his clock. Such occurrences cannot fairly be called accidents. Almost every living man from the commencement of the world must have seen something similar, but it required a Galileo to detect its value, and to trace its important consequences.

In the following century, the astronomer Bradley was engaged in a series of observations on the stars, intended to obtain a decisive proof of the motion of the earth from the known principle of parallax, when, instead of what he was looking for, he observed another, and to him unaccountable, apparent motion of the stars. He had long endeavoured to find some solution of the difficulty, and his mind, no doubt, was full of it at the time, when, in sailing in a boat on the Thames, he noticed that the vane at the mast-head was directed to a different point of the compass at each tack the boat made, though the wind itself had in no respect changed. In fact, a vane under these circumstances, being partly acted on by the wind, and partly by the motion of the boat itself through the air, assumes a position intermediate between the two directions. It immediately struck Bradley that his observed motion of the stars might be similarly accounted for; that the ray of light, the direction of which he had been measuring with his telescope, might be compounded of the real direction in which it was moving from the star, and of the direction which the earth itself was advancing at the time; so that, as the earth kept changing its direction in different parts of its orbit, the apparent direction of the star would vary just as that of the vane did. This supposition he was afterwards fully able to verify, and it forms to the present day, or till within the last few years, at any

rate, did form, the only actual, visible proof we have of the motion of the earth round the sun.

The telescope is said to have originated in an accident. The children of a spectacle maker in Middleburgh were playing with some of the glasses, and, happening to look through two of them, placed one behind the other, saw the weathercock on a steeple opposite greatly magnified, but inverted. The father, having his attention called to the singular effect, fixed up two glasses in his shop at the proper distance, and directed to the weathercock. All the passers-by stopped to wonder at the curiosity, till it struck somebody that the glasses might be inserted into a portable tube.

After the telescope, which alone has enabled astronomy to reach its present perfection, perhaps the most important instrument is the sextant, without which our astronomical knowledge could never have been turned to much account in navigation. You know that the object of such observations is to measure the angle between two objects, as the sun above the horizon, or the moon from a particular star. Now, at sea you cannot direct one of your sights towards one object, and one towards the other, and then read off the angle at your leisure. Amidst the incessant rolling and pitching of the vessel, you cannot use any such fixed instruments as you can employ on the shore, but must be enabled to catch an instantaneous sight of both objects at the same time. This is accomplished by viewing one object directly, and the other after a double reflection from two mirrors. One of the little mirrors is fixed, and the other is moved, till you bring both objects exactly to coincide, when the angle between the two mirrors is proved mathematically to be exactly half of that between the two objects. Now, this valuable instrument had certainly two, and perhaps three, independent inventors. The first in order of time was undoubtedly Sir Isaac Newton, though the invention was not made public for some time after. Another, and certainly an independent one, was a glazier of Philadelphia, who is said to have conceived the first idea from noticing the reflection of the opposite houses between two panes of glass, with which he was preparing to mend a window. There have been, without doubt, many as skillful glaziers as poor Godfrey, and certainly many more industrious ones—for he was a sad dissipated fellow—but not very many who had sufficient acquaintance with mathematics to make a profitable use of such a casual observation. We are told that Godfrey was devoted to such studies; so much so, that when the Royal Society voted him £200 for his invention, they laid it out in a present of furniture and linen to his wife, as he spent all his earnings in mathematical books—and drink.

Now in these anecdotes, which I have related as examples of the manner in which discoveries are generally brought about, you will observe that there are two circumstances which are common to them all. The discovery was connected with the practice of the profession of the man who made it, or with the study which then occupied his attention, and there existed beforehand a competent knowledge to turn to account the new idea suggested to his mind. They tend to illustrate and confirm the proposition with which I commenced, and with which I will also conclude: that practical men, working mechanics, are more likely than any other class to encounter those obscure hints and suggestions of nature which are the seeds of great discoveries; that they are the most able of all men to detect the practical application of which the idea is susceptible, but that, without some preparatory training and scientific acquirements, all those advantages must of necessity be thrown away.

Great Western Railroad.

The Great Western Railway is two hundred and twenty-eight miles in length, and it forms, with the American roads east and west of it, one of the most important of all the routes between the Atlantic and the Mississippi, Commencing in the West at the head of Lake Erie, where the Michigan roads and daily steamers connect it with all the shores of the great upper lakes and the exhaustless lands of the north-western States—touching with its boundaries Lakes Huron, St. Clair, and Ontario—and terminating in the East on the Niagara river, where two railroads and the Erie Canal connect it with the seaboard—and commanding in the water Communication of Ontario and the St. Lawrence an independent channel to Montreal and Quebec—it certainly possesses extraordinary advantages, and must hereafter serve a most valuable purpose. The road was projected eight years ago, and had to experience its full share of the difficulties usually attendant upon such an enterprise. Its cost has been about eight millions of dollars, about one million of which was subscribed in Canada, about one million in the United States, and nearly a million by the British Government: the remainder has been raised by the sale of stock and bonds, in Great Britain. Its line of location is in some respects remarkably favorable. Ninty-five per cent. of the whole distance is perfectly straight, and the curves on the remaining distance are mostly very slight.

A distance of 183 miles is either entirely level or exhibits inclinations of less than five feet per mile; and the slopes on the remainder are mostly less than 20 feet per mile. The summit is 360 feet above the western terminus, the maximum grade on the west side of which is twenty feet per mile, and on the eastern side forty-five feet per mile, the latter of which is all confined to a distance within twelve miles of Hamilton.

The soil east of London is generally composed of sand and gravel; west it is more mixed with clay. For some twelve or twenty miles west of Chatham the road passes through low wet prairies, and was built at great expense, the material for its grading having been taken from the marshes with dredging machines and by coffer dams, or hauled, over a long distance, from the lake shore. For a mile and a half the track runs over piles.

Near London, and also both east and west of Hamilton, are many heavy excavations and embankments. Over the Twenty Mile Creek is a bridge 1200 feet in length and eighty in height, and not far distant is another eight hundred feet in length of the same height. The road, though the regular traffic upon it has already commenced, cannot yet be considered as complete. A considerable portion of it has not yet been gravelled up to the ties, and many places it runs over temporary tressel work. Still the work has been done with great expedition, for a year ago but very small and detached portions of the grading on any part of the line had been completed. The road appears to be strong and firm enough now, but there are many who think it will not sustain unharmed the severe tests of the coming spring.

The line is laid with a single track, but its culverts and bridges are so constructed as to admit of a double track when one shall be required. The guage is five feet and a half, and therein I believe exclusively Canadian. The engineers of the work, and most of the contractors are Americans. Two or three of the directors of the company have been and still are Americans; but notwithstanding, the common principles of human nature have had play in the doings of the corporation, as the following amusing specimen goes to show: The first chief engineer of the road, after a service of four or five years, resigned to take office at Washington. One of his associates was appointed successor, and the Board heralded the qualifications of the new officer in very emphatic terms.

One of his first duties was to render a detailed estimate of the cost of the line in place of the general estimates of his predecessor. He did this, and, after careful examination, confounded the Board with a result which exceeded the original estimate more than a million of dollars. There was no standing such a wet blanket, and the Chief Engineer was indignantly driven from his post. Another was appointed, an Engineer of high standing in the United States. He, after patient investigation made a report of estimates which exceeded those of the last a million and a half of dollars, those of the first two million and a half! The shock was a terrible one, but human nature had to yield to the nature of things, and the Directors submitted. The result has completely justified the last estimates.

The locomotive engineers are American and English; the conductors Scotch, and also most of the subordinates. The locomotives were mostly built at Shenectady or at Lowel; the cars, which are very spacious and elegant, were manufactured in the province at Hamilton. The rails weigh from sixty-five to eighty pounds to the yard, and not having been subject to tariff dues, cost something like twenty-five dollars per ton less than the price of similar iron in the United States. The fare on the route is three cents a mile, which is one cent more than on most Northern roads in our country. It is expected that the entire two hundred and twenty-eight miles from Niagara to Detroit will be run in eight hours, and the entire distance between Chicago and Albany, 837 miles by nearly a straight line, in twenty-nine hours.

A suspension bridge connecting the line with the Rochester and Niagara road, is in process of construction. Though it extends directly over the present suspension bridge for general travel, it is not connected with the latter at all, its heavy stone abutments being built outside, and the wire-work some fifteen feet above, being entirely independent. It will have but two cables, one on each side, each of

the strongest twisted wire and nine inches in diameter. The present bridge has eight cables, four on each side, each about two inches in diameter. The bridge will be well made, I doubt not, but whether it will be well travelled is another question. Money will suffice for the former, but something more is requisite for the latter, and something which I hardly think the company will supply. I meant *pluck* for the passengers; for however pleasant "riding on a rail" may be on *terra firma*, this flitting on a stick, whether a broom stick or an iron stick, two hundred feet over an abyss blacker and fiercer than Acheron, for a good long furlong or two is a different matter. "—*Railway Journal.*

Opening of the Buffalo and Brantford Railroad.

The Buffalo and Brantford Railroad, as originally designed, has at length been completed and cars are now running over it. This road was projected several years since and a reconnoisance made of the route by Mr. Wallace, who found it to be not only an entirely practical one, but one highly favorable.—For sometime after this the enterprise slumbered, and no steps were taken to enter upon it in earnest. A little over two years since the project was revived, in the first instance, we believe, by the citizens of Brantford. This action on their part was prompted, in a measure, by that of the Directors of the Great Western road in deciding upon Paris, six miles beyond, as the point through which the road should pass. Men of energy took hold of it, and succeeded in obtaining a considerable amount of subscriptions to the stock, principally by the municipalities along the line. They visited Buffalo, and the matter was laid before our citizens, and by them favorably considered. The result was a subscription on the part of the city, of one hundred and fifty thousand dollars to the capital stock. This secured the completion of the road, and the services of our then Mayor, James Wadsworth, Esq., in the Directory, and subsequently as President of the Company.

When the enterprise was first entered upon, it was under a general Plank Road Law—the provisions of which were constructed to authorise the construction of a railroad. This, however, was denied, by some, and the road encountered a powerful opposition from Sir Allan McNab, and others in the interest of the Great Western Road.—Eventually, however, the Provincial Parliament confirmed and enlarged the franchises of the Buffalo and Brantford Company by a special charter. Thus fortified, they went forward. A financial measure of much importance, not only to this road but to all others in the Province, was about this time adopted—a measure of wisdom in its conception, and of great beneficial results in its operation. The municipalities, town and county, had voted to issue the debentures, for internal improvement purposes, to a large amount. These could not be negociated except at a ruinous discount. Parliament passed an act by which these were taken by the government and its debentures to the same amount issued. These commanded a premium. The par value of the municipal debentures was paid over, and the premium transferred to a sinking fund for their redemption. They all bore six per cent. interest; but the municipal authorities raise eight per cent.—The difference going to the sinking fund.—The Buffalo and Brantford company pay their six per cent on the debentures issued for their benefit as they have also done on the bonds issued by the city; and the dividends will go in the same direction when the road is in full operation. This measure enabled them to raise funds; without which it would have been difficult to realize them.

The road from the Niagara River to Brantford is not far from seventy-five miles in length. It is constructed on a guage of five feet six inches—uniform with all the roads in Canada. This is a convenient width—preferable on the whole, to the wider or narrower guage The country through which it passes, is an unusually level one—offering but few engineering obstacles in the whole distance. There are but two considerable gradients in the whole line—one of about forty feet to the mile, west of Dunnville, and another of about thirty feet, between Caledonia and Brantford. Compare this with a single section of the Great Western, as it goes out of Hamilton. For three continuous miles there is a grade of sixty-five feet to the mile, and for the next four miles, of forty-five feet to the mile. It will be seen, therefore, that the grade on the Buffalo and Brantford Road, offers no impediments to high speed or heavy freightage. In addition to this, seventy-one miles of the seventy-five are straight lines, and there is no curve with a radius of less than two miles and a half. There are but a few inconsiderable embankments, so that if a train should happen to run off the track, but little damage could result. The cost of the road, absolutely and comparatively, is much in its favor. With a rolling stock consisting of ten first class locomotives—two of which equal the "Racer" and the "Richmond," on the Central—twelve elegant passenger coaches, and baggage cars sufficient to do a large business—the cost has been but $19,000 per mile. This is much cheaper than any other road that has been constructed;—and the Great Western cost $60,000 per mile. This difference is owing to the nature of the surface over which the roads pass.

That the opening of this road is to be of great benefit to Buffalo, will, we think, soon be shown. The section of Upper Canada which it penetrates and opens to us, is but little known to our citizens. From the difficulty of access, it has hitherto been an almost *terra incognita.* In point of soil or climate it is equal to any part of the State of New York. And, as a wheat growing region the Grand River Valley is not surpassed by that of the far famed Genesee. The country immediately bordering upon the Road, is not a good representative of the district—as it avoids as far as practicable, the improved lands, in order to secure the right of way on more favorable terms. It passes through three large villages between here and Brantford, and six miles beyond is Paris, with extensive hydraulic power, and a population of between three and four thousand. At this point the Brantford road intersects the Great Western—both running into the same depot—thus being in communication with Detroit, and enabled to land passengers here from the west, two or three hours in advance of the Great Western route.

It may be as well to mention here, as a part of the history of the road, that the original plan has been enlarged, and that it is to be extended to Goderich, on Lake Huron, eighty-five miles farther, and one hundred and sixty from Buffalo. The contract for the Western Division has been entered upon and much of the grading already done, and it is contemplated to have the "iron horse" put through from one Lake to the other by the first of November 1854. The gradation is already far advanced, and is in the hands of energetic contractors who will push it forward with all possible despatch. When this is completed, a man may start in New York one morning, and wake up in Makinaw the next. The distance from Buffalo to Goderich, being one hundred and sixty miles, can be easily run in five hours.—*Buffalo Courier.*

Prizes Awarded at the New York Crystal Palace.

Below we give a list of the prizes awarded to Canadian competitors at the New York Crystal Palace. There were in all one hundred and fifteen silver medals granted, of which the greatest number fell to the United States. France received 51; Great Britain 9; Germany 5, and Switzerland, Australia and Italy one each. Of the bronze medals, the United States has 505, Great Britain 148, France 153, Germany 106, Prussia 30, Belgium 10, Switzerland 29, Holland 12, Austria 18, Italy and Sardinia 44, British America 26, &c. As a contemporary very justly remarks—"Had better arrangements been made, we have no doubt that Canada would have figured much more prominently in the prize list." And we have no doubt, that had sufficient information been diffused to inspire confidence in the undertaking, that Canada would have been very much better represented. The following is the list of the 26 premiums awarded to Canada and the Lower Provinces:—

Bell, Messrs. Quebec, Canada East, for specimens of Earthenware.

Peter, C. H. Riviere Ouelle, Canada East, for general excellence of specimens of Leather, from the Ouelle River, from the skin of the porpoise.

Indians of Loretto, Canada, for general excellence of specimens of dressed and undressed Deer and Moose skins, prepared by themselves.

Van Brocklyn, Winter & Co., Canada West, for a Threshing and Separating Machine.

Globensky, Miss., Lachine, Canada, complete set of Embroidery for Furniture.

Geddes, Rev. J. F. Hamilton, Canada West, Berlin Wool Carpet.

Bouchard, J. B. Madame, St. Villiere, Canada, Counterpane and knitted Linen Curtains.

Knight, Wm. St. John's, Newfoundland, for Model of Seal Fishery.

Thompson, Miss Kate, Toronto, rose point Lace Collar.

Tetu, J. Berthier, Canada, Woollen Night Caps.

Thompson, Mrs. Quebec, Baby's Knitted Dress in Crotchet work.

Saurin. J. J., Quebec, Canada, Two Sleighs.

Dutton, Miss Eliza, Montreal, Knitted Cradle Quilt.

Picton Mines, Nova Scotia, Coal, illustrating veins.

Sydney Mines, Nova Scotia, Coal, illustrating veins.

Ziegler, J. B. Quebec, Cornopeon, ingenious.

Kearney Richd, St John's Newfoundland, for a model of a Ship's Hull.

Reinhart, C. Montreal, Canada, for superior Hams.

Royal Agricultural Society, Prince Edward Island, for samples of Wheat, Oats, Buckwheat, &c., exhibited by Whitman & Wheelock, New York

Patterson J., Elgin Mills, Dundas, Canada, for specimens of Twilled Blankets. With special commendation as the best exhibited.

Upper Canada Provincial Agricultural Society, for a very fine sample of White Wheat, produced by J. B. Carpenter, Townsend, Canada West, weghing 66½ lbs. to the bushel.

Martel, Mlle P., St. Ambroise, Canada, Lace Caps and Collars.

McGrath, James, Toronto, Berlin Wool Carpet.

Hollowell, W. Antrobus, Quebec, C. E., for an ingeniously contrived Fruit Gatherer.

Jobin Mad, J. B., Quebec, Knitted Woollen Over Socks.

Winter, Dr. John, Chairman of Committee of Gentlemen, residents, of St. John, Newfoundland, for specimens of Barley and Oats, and preserved and smoked Meats.

HONOURABLE MENTION.

Madam Lamere, St. Laurent, C. E.—samples of Colored Beans.

——Lambly Quebec—samples of Maple Syrup and Maple Sugar.

J. Muir, Hinchinbrooke, C. E.—cheese.

R. C. McMullen, Toronto—specimens of Irish Lundy Foot Snuff.

M. Pacquet, Quebec— sample of Beans.

John B. Pabb, Montreal—Wine Crackers.

Betsey Rousseaux, St. Hilaire, C. E.—Maple Sugar.

Francis Silverthorne, Toronto,—samples of Pot and Pearl Barley.

P. C. Sinclair, Cobourg—superior Cobourg Sauce.

E. W. Thompson, Toronto—samples of Barley.

Asa Westover, Durham, C. E.—samples of Maple Sugar and Syrup.

A. McFarlane, Montreal—samples of Glue.

Caroline Schiller, Montreal—Bark box with Moose Hair, &c.

M. Pacquet, Quebec—Dressed Flax.

John Robertson, Long Point, C. W.— a Seed Sower.

Hypolite Blouin, Berthier, C. E.—Timothy Seed.

Louis Bovin, Cacouna, C. E.—samples of Wheat.

Smith Bartlett, Bellville—samples of Peas.

J. W. Bailey, Megantic, C. E.—Maple Sugar.

Francis Conture, St. Ambroise, C. E.—Skinless Barley and Canadian Oats.

Thomas Moore, Thornhill, C. W. Specimens of Axe Handles.

Quebec Industrial Exhibition Committee—Money Purse, Table Mats, Knife Sheath, Musk-rat and Mink Skin Bags, ornamented Moose Deers and Carriboo Foot, Bark Wood, Card Trays, Baskets, Cigar Cases, prepared, manufactured and ornamented by Loretto Indians.

——McLaren, Yamaska, C. E.—Specimens of Roofing Tiles and Brick.

James Herring, Toronto—White Marrowfat Peas.

L. A. Cummer & Co., Watertown ; A. Griffin, Ranson Mills, Watertown ; J. B. Ewart, Dundas.—Samples of Flour.

Col. Irvine, Quebec—a Maple Table Top, decorated with the Natural Leaves.

James Morgan, Quebec—Design and Cutting Gothic Stone Front.—*Colonist.*

The "Niagara Mail" on Lord Rosse's Discoveries.

The Niagara *Mail* of the 8th February, in a notice of the January number of the *Canadian Journal*, remarks at length upon the lecture by the Rev. W. Scoresby on the Earl of Rosse's Telescopes and their revelations in the Sidereal Heavens.—We subjoin a portion of the notice of the *Mail*, in which attention is drawn to a curious and interesting passage in the works of Emanuel Swedenborg.

"This discovery of the spiral motion of starry systems among each other is supposed to be original, and as such is styled the "Rossean Configuration."—But it is remarkable, that over a hundred years ago, viz :—in 1755, the celebrated Emanuel Swedenborg in his work on the "Worship and love of God," promulgated the same fact, and showed that the starry systems move round each other, in forms different from those of the planets round the sun ; he styles those higher forms *spiral* and *celestial*—and in fact, asserts the very theory which the Rossean telescopes have recently demonstrated to be true. As this work is very rare, we adduce a passage on this point, and also his general views on the *forms* of celestial motions, which are striking—when considered in connection with the late discoveries in physical astronomy :—"

Around the great system of the sun, and its wandering orbs, and of the moons which accompany them, shine innumerable stars, which constitute our starry heaven, divided into twelve signs, according to the sections of the zodiac, and present its immensity visible. All these stars remain fixed, and as images of the great sun, being immoveable in their centres, they also occupy a kind of a plane, excited by their rays, which they subject and ascribe to themselves as their own proper universe. There are therefore as many universes as there are stars encompassing and crowning our world, according to the virtue and quantity of light emitted from them, greater and lesser. These heavenly circuses mutually press and bind each other by contact, and by continual concatenations enfold together a heavenly sphere, and by infinite orbs complete a form, which, is the examplar of all spheres and forms, in which all and singular the starry orbs harmoniously conspire to one and to the same end, viz: that they may mutually establish and strengthen each other, by virtue of which union resulting from the perfection of the form, this complex of universes is called the firmament ; for in a grand body thus consociated, no member claims anything to itself as its own, unless it be of such a quality that it can flow in from what is general into what concerns itself, and again, as by an orb, can re-flow into what concerns the other universes, or into what is general ; on which account also they do not shut up their lights and torches within their own sphere, but diffuse them even into the opaque bodies of the solar world, and into their earths, and when the setting sun causes night in the hemisphere, they supply his place.

This form, which the stars with their universes determine or coeffect by intermixture and harmony with each other, and which on that account is called celestial, cannot at all be acknowledged as the most perfect of all forms in the world, if we depend only on the view presented to the spectater's eye on this globe of earth ; for the eye does not penetrate into the distances of one star from another, but views them as placed in a kind of expanse, one beside another, hence they appear as without order, like a mass of confusion. Nevertheless, that the form resulting from the connecting series of all the starry universes, is the exemplar and idea of all forms, may appear not only from this consideration, that it serves as the firmament of the whole heaven, but also from the consideration, that the first substances of the world, and the powers of nature gave birth to those universes, from which, and their coöperation, nothing but what is perfect flows forth ; this is confirmed also by the distances of the stars from each other, preserved for so many ages, without the least change intervening.—Such forms protect themselves by their own proper virtue, for they breathe somewhat of perpetual and infinite ; nevertheless, they cannot be comprehended as to their quality, except by lower or lowest forms, the knowledge of which we have procured to ourselves from objects which affect the sight of the eye, and further by continual abstractions of the imperfections under which these forms labor. But let us view these forms in their examples ; the lowest form, or the form proper to earthly substances, is that which is determined by mere angular and at the same time by plane subjects, whatsoever be their figure, provided they flow together into a certain form ; this therefore is to be called an Angular Form, the proper object of our geometry. From this form we are enabled to contemplate the next superior form, or the form perpetually angular,

which is the same as the Circular or Spherical Form; for this latter is more perfect than the other in this respect, that its circumference is, as it were a perpetual plane, or infinite angle, because totally void of planes and angles; on which account also it is the measure of all angular forms, for we measure angles and planes by sections and sines of a circle: from those considerations we see, that into this latter form something infinite or perpetual has insinuated itself, which does not exist in the former, viz: the circular orb, whose end and beginning cannot be marked. In the circular spherical form, again, we are enabled to contemplate a certain superior form, which may be called the perpetually circular, or simply the Spiral Form; for to this form is added, still further, somewhat perpetual or infinite, which is not in the former, viz: that its diameters are not bounded or terminate in a certain centre, neither are they simple lines, but they terminate in a certain circumference of a circle or superficies of a sphere, which serves it instead of a centre, and that its diameters are bent into a species of a certain curve, by which means this form is the measure of a circular form or forms, as the circular is the measure of the angular. In this spiral form we are enabled to view a still superior kind of form, which may be called the perpetually spiral or Vortical Form, in which again somewhat perpetual or infinite is found which was not in the former; for the former had reference to a circle as to a kind of infinite centre, and from this, by its diameters, to a fixed centre as to its limit or boundary; but the latter has reference to a spiral form as a centre, by lines perpetually circular; this form manifests itself especially in magnetics and is the measure of the spiral form for the reason above mentioned concerning inferior forms. In this, lastly, may be viewed the highest form of nature, or the perpetually vortical form which, is the same with the Celestial form, in which almost all boundaries are, as it were, erased, as so many imperfections, and still more perpetuities or infinities are put on; wherefore this form is the measure of the vortical form consequently the exemplar or idea of all inferior forms, from which the inferior descend and derive birth as from their beginning, or from the form of forms. That this is the case with the formations of things will be demonstrated, God willing, in the doctrine of forms, and the doctrine of order and of degrees adjoined to it. From this form those of faculties and virtues result, by virtue whereof one thing regards another as itself, nor is there anything but what consults the general security and concord, for in that form there is not given any fixed centre, but as many centres are there as points, so that all its determinations, taken together, exist from mere centres or representations of a centre, by which means nothing can be respected as proper to it, unless it be of such a quality that from what is general, or from all the centres, which taken together produce what is general, it may flow in into itself as a similar centre, and may reflow through an orb for the benefit of all, or into what is general.

Natural History in its Relation to Agriculture.

Abstract of a Lecture delivered before the Toronto Mechanics' Institute by Professor Hincks.

I proceed to point out some more immediate special applications of the knowledge of natural history to the business of the farmer. Many of the diseases to which cultivated plants and domestic animals are subject, and which sometimes occasion very extensive mischief, depend on the presence of parasitical plants or animals often exceedingly minute. The first step towards remedying the evil is to understand its real cause, and it must be evident that the more that is known of the structure, nutrition, and reproduction of the parasites, the more successfully can we attempt to limit their ravages. The ergot, must, rust, and mould, on the grain producing plants, are minute and very curious fungi whilst serious injuries are caused by plant lice, a tribe of insects of very remarkable characters, which under the names of black fly, green fly, and American blight, given to the different species are well known by their occurrence on wheat, beans, hops, and apple trees, as well as on roses, and other plants. No one of this tribe, indeed, is altogether injurious; writers have attributed some species to the potato blight, but tho' it is well known that the potato, like many other plants, is occasionally infested by aphides, which are either a cause or a symptom of weakness and bad health; it has been abundantly proved that the aphides are present without causing the disease, and the disease exists without the presence of aphides; the species, too, which has been accused of causing the disease, and has in consequence been extensively distributed under Mr. Smee's direction as a microscopic object, turns out to be a common species occurring on many plants, and never before suspected of peculiarly malignant influences. Much better founded is the supposition that an internal fungus is the immediate causes of the potato disease, but until we can determine whether it really produces the decay or only arises out of it, and what are the causes, atmospheric or otherwise, of its prevalence in particular seasons, we cannot acknowledge the resources of science to have been exhausted in vain against this mysterious plague. It deserves consideration, whether all the remedies that have been employed with most appearance of success may not have their efficacy accounted for by their destroying the vitality of the spores of the fungus in the sets, whilst the presence of the spores from other sources would explain their occasional failure. On the whole, I cannot but think the fungoid theory the most rational. We have seen at least that the aphis theory is entirely without foundation; that of the wearing out of the varieties, is disproved by the notorious fact that all varieties, new or old, are about equally liable to the disease, none more so than seedlings, and even seedlings raised from seed brought from the native country of the potato. The theory which attributes the disease to superfluous moisture occurring in particular seasons is disproved by its recurrence with very great variety in the character of the seasons, and in all sorts of situations, whilst the theory of the dependence of the plague on the peculiar atmospheric states, electrical or otherwise, is too vague to be listened to in the absence of specific facts, and is only an indirect acknowledgment of entire ignorance on the subject. I need not now refer more particularly to the injuries suffered by domestic animals from the attacks of various insects, but none, I am sure can possess even a slight acquaintance with the peculiar instincts of certain insect tribes, and the manner in which some of them accomplish such extensive mischief, without perceiving how usefully the knowledge of their nature connects itself with the business of the farmer. Then there is the whole subject of our relations with the wild birds and animals of our country. Probably most country people are indiscriminate destroyers of all the wild creatures that fall in their way, whilst a few influenced by feelings of kindness, or a regard to beauty, are indulgent to all excepting a few of the most obviously and extensively injurious. A little knowledge of Natural History would assist us in judging what creatures are really our enemies, and which we should protect as friends and allies, and would at the same time enable us to carry on the war most successively where it is necessary from a just regard to our interests. If we recall to mind the silly prejudice to which the harmless and even useful hedgehog is as commonly sacrificed in England, or consider the general disposition to destroy birds without much distinction of kinds, we see how beneficial a little knowledge of natural science would be to the dweller in the country. It would thus be decided that the larger and more powerful birds of prey are enemies, because our domestic animals would be among the chief objects of their attack; but the owl tribe, feeding chiefly on small quadrupeds, aid us in our necessary warfare against mice and rats without doing any material damage. The numerous insectivorous birds are all eminently useful, as are those which feed on small seeds, but a few of the frugiverous tribes feeding much on our favorite fruits can only hope for partial indulgence on account of their beauty or their song. In the case of the omnivorous birds which live during a large part of the year on grubs, caterpillars, and other insect prey which they hunt with admirable skill, but which also attack at certain seasons grain and roots, we are obliged to strike a balance between the benefit and injury we receive in which a sense of the happiness of the creatures and admiration for their beauty, and their wonderful instinct, must be allowed some weight in their favor. Such creatures may reasonably have their increase somewhat limited, but if we had the power utterly to destroy them we should soon feel the evil we should thus have brought upon ourselves. We have read of instances in which the extermination of the common European sparrow has been attended with disastrous consequences to the farmer; and although the rook is loudly condemned by some, the sight of numbers of them following the plough, picking up grubs, worms, and insects, should cause the considerate farmer to relent, even though indignant at thefts among his potato set and his ripening grain. More illustrations taken from familiar objects in England will show the importance of similar considerations here, and will satisfy every one that the spirit of wanton destruction and persecution often indulged against the inferior animals is as unwise as it is barbarous; that we should destroy only what we evidently perceive to be injurious and unfitted to dwell in any connection with ourselves, and should see with pleasure the various races of animated beings enjoying themselves around us so far as they may be permitted to do so without any serious interfe-

rence with those pursuits which are essential to our welfare, and which are manifestly designed to exercise our industry and skill. In respect to all the inferior animals we may accept of the decision of the poet:

If man's convenience,
Or health or safety interfere, his rights
Are paramount and must extinguish theirs.
Else they are all, the meanest things that are,
As free to live and to enjoy that life
As God was free to form them at the first,
Who in His sovereign wisdom made them all.

Let me conclude with one word as to the pleasure to be derived from the study of Natural History in connection with a country life. What pursuit can we name in which the charms of beauty, variety, and the exercise of various mental faculties are so united? What can we imagine so well calculated to enliven our interests in the scenes of nature, to make each changing season only a change in our pleasures, and to connect the ordinary occupations, and even the sports of rural life with observations and inquiries full of entertainment as well as usefulness.

The Late Remarkable Weather in England.

At the last meeting of the British Meteorological Society, January 24, a paper was read, "On the Meteorology of the Past Quarter, in connection with the Fall of Snow at the beginning of the Year," by James Glaisher, Esq., F. R. S. In commencement, Mr. Glaisher spoke of the value of association as afforded by the society, to the members of which he was chiefly indebted for the observations upon which his paper was based. The different elements of investigation were treated singly, that the bearing of each upon the other might be clearly shown. "For," observed Mr. Glashier, "the correctness of the accepted truism that in nature no phenomena is isolated was never better illustrated than at a time when the readings of the barometer and thermometer, the dense fogs, the heavy snow, and the pertinacious east wind formed a combination—one scarcely more abnormal in its departure from the average than the rest."

In October, between Jersey and lat. 51°, the mean temperature declined 4°; between lat. 51° and 53°, there was no difference. In November, south of lat. 51° and north of lat. 53° it declined about 6°; but between these parallels to 9°, forming a band of cold the greatest that was experienced, and which held its ground during the long period of two months. Fog was one of the most remarkable features during the quarter. In November fogs frequently enveloped the whole country at one time, and were of great density. They chiefly occupied the band of cold between lat. 51° and 53° before mentioned.

The first fall of snow took place in the neighbourhood of Chester, in November. After Dec. 15, it fell at nearly every place; but more frequently between lat. 51° and 53° than elsewhere. On December 15 it was, in many places, as deep as six inches. On the following day, the temperature as registered at Manchester, was as low as 6°, but the maximum cold for the season took place on the night common to Dec. 28 and 29. This cold extended as far as our meteorological stations, from Jersey to Arbroath, in the North of Scotland. The extreme severity of Jan. 3rd was not at all felt south of the parallel of Uckfield, in Sussex. About London and its vicinity the reading of the thermometer fell early in the morning to 10°, 11°, 12° and 13°. It had reached the low points at one o'clock in the morning, and did not rise above them till eight o'clock. It was most severely felt in the Midland Counties, where the reading was as low as zero. By Mr. Lowe it was estimated at 4°, this is the lowest reading observed by any one—it was lower, than any in the immediate neighbourhood.

A number of original communications from various observers were read by Mr. Glaisher, on the fall of snow on January 3, which was generally distributed over the country, but lay deepest between the parallels of latitude occupied by the fog and extreme cold. In parts of Cornwall there was none or very little; whilst at Holkham, on the Norfolk coast it was 18 inches on the level. At Whitehaven there was scarcely an inch; but at Liverpool, and other places in the same parallel 6, 10, and 14 inches fell. The north was, in parts comparatively clear; and in parts of Northumberland no snow at all fell on the day of the great and general fall. There had been much snow previously, and it then lay on the ground to the depth of several feet. The drifts over England and Wales varied from 3 feet to 10, 12, and 15 feet. They were very deep at Derby and at Grantham, and upon the Norfolk coast.

In conclusion, as connected with the severity of the weather as falling beneath his own observation, Mr. Glaisher remarked that trees were sheathed over with ice for some days, till Jan. 4, when it began to crack, and fall to the ground. Beneath a row of trees in the immediate vicinity of his house it was literally strewn with large fragments, each retaining the curvature of the branch it originally encased. Animals, ordinarily exposed on Blackheath, suffered severely, and two were observed frozen to death; also birds, which had fallen dead from the trees, were picked up in the immediate neighbourhood. The number of crystallised flakes mingled with the snow was another indication of the low temperature under which it had been formed. Mr. Glaisher laid before the meeting a number of photographic copies of several he had himself observed on January 1 of the present year.

At the conclusion of the paper, J. C. Whitbread, Esq., rose and commented upon the value of the paper, and the elaborate nature of the work. A vote of thanks was moved to Mr. Glaisher, and unanimously carried. The meeting was numerously attended.

The Iron Trade.

The number of iron furnaces in Scotland on Dec. 31, 1853, was in blast, 114; out of blast, 29; total 143. The stock in hand at the 31st December, 1852, amounted to ..... 450,000 tons.
The production during 1852 was equal to ..... 710.000 „

Total ..... 1,160,000 „

The home demand in founderies and maleable works in 1853 was ..... 300,000 tons.
The exports ..... 650,000 „
950,000

Stock on hand at the close of December last ..... 210,000 „

The reduction of stock is thus 240,000 tons on the transactions of the year; and another season of similar business would entirely sweep it away. The average price of pig iron during the year has been 61s., and the value of the manufacture has therefore been £2,165,000. The average price of bar iron has been 187s.; and if the Scotch makers had turned their pigs into that class of iron, the value would have been £6,638,500. The average prices of bar and pig iron for the last nine years are appended:—

	Bars.	Pigs.
	s.	s.
1845	190	80
1846	195	67
1847	165	65
1848	110	44
1849	117	45
1850	109	44
1851	107	40
1852	210	45
1853	187	61

Bar iron does not invariably follow the rise or fall of pigs, and the great fluctuations in price are more severely felt in the crude than in the finished production. This fact should induce the Glasgow capitalists to manufacture a greater quantity of bars and castings, and sell less of their iron in the first step from ore.

The iron produced in Great Britain is now equal to three millions of tons. In pigs, as Scotch bring lower prices than Staffordshire or Welsh, the total present value is not less than ten and a half millions sterling. In its manufactured form into bars the value must be twenty-eight millions. The value of the metals produced at present within the island is quite fifty millions—a larger sum than was ever formerly extracted from any land in the metallic business. A calculation of the value, with the additions in the cutlery, edge-tool, engineering, and hardware trade, would bring up the aggregate to one hundred millions for 1853.

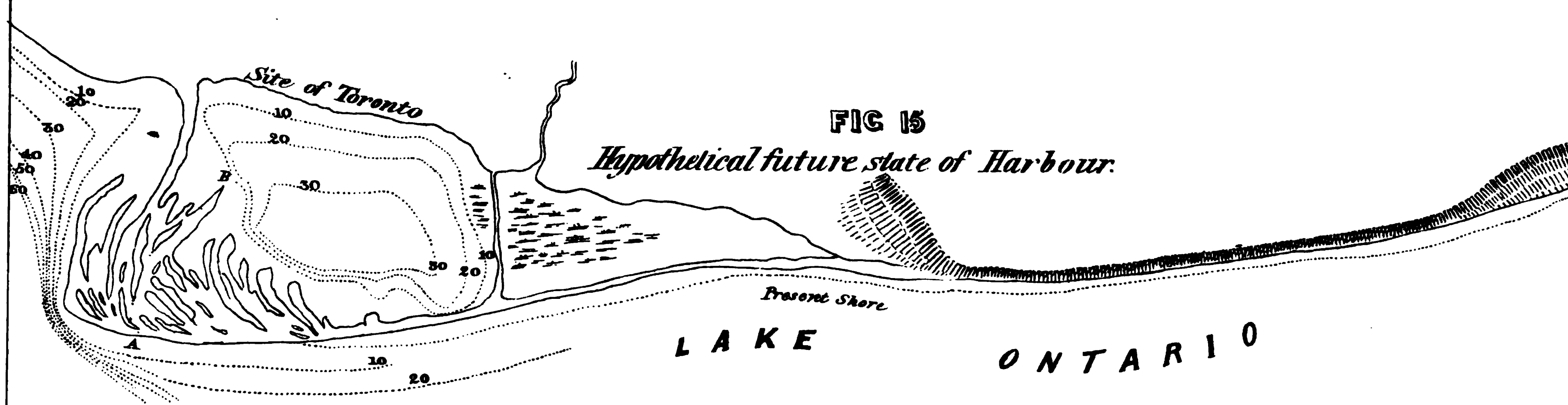


FIG 15
Hypothetical future state of Harbour.

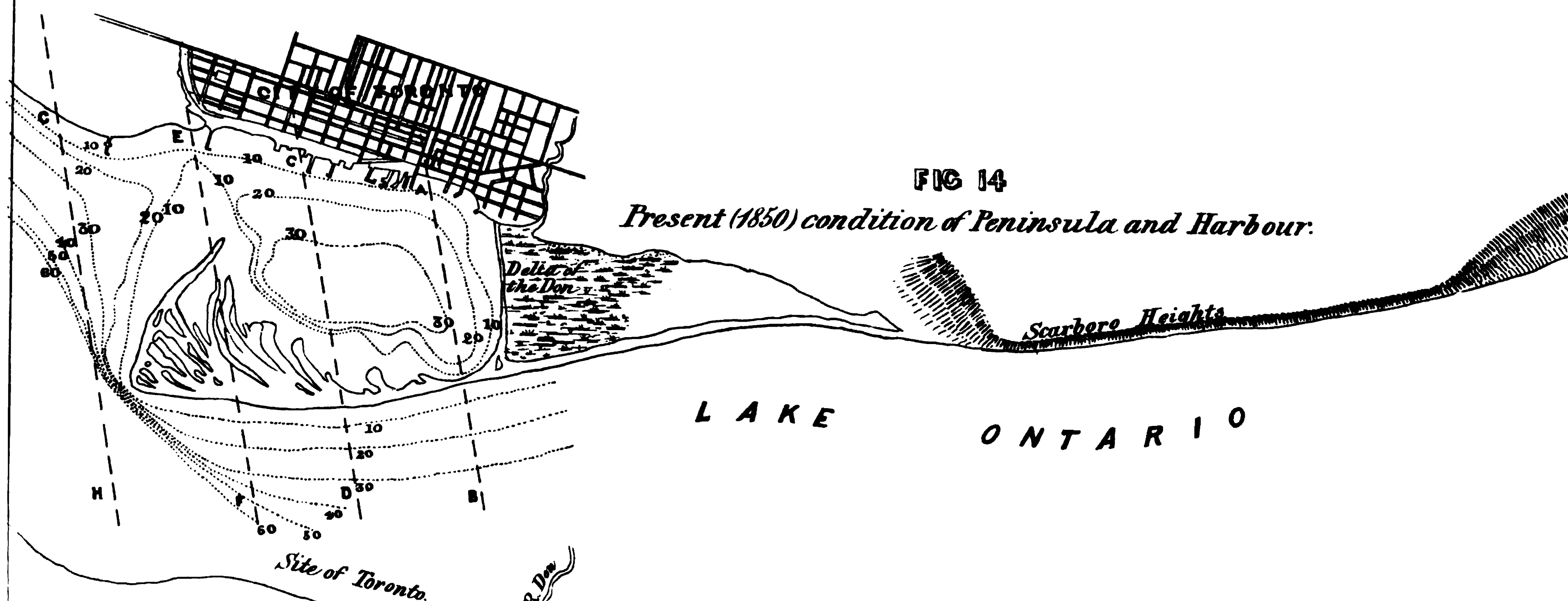
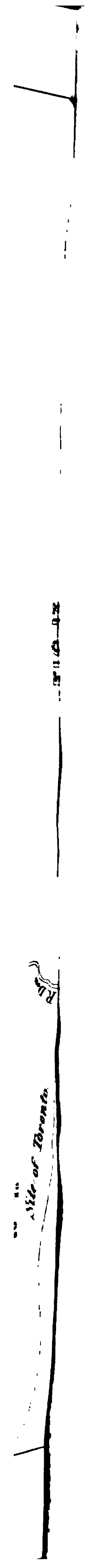
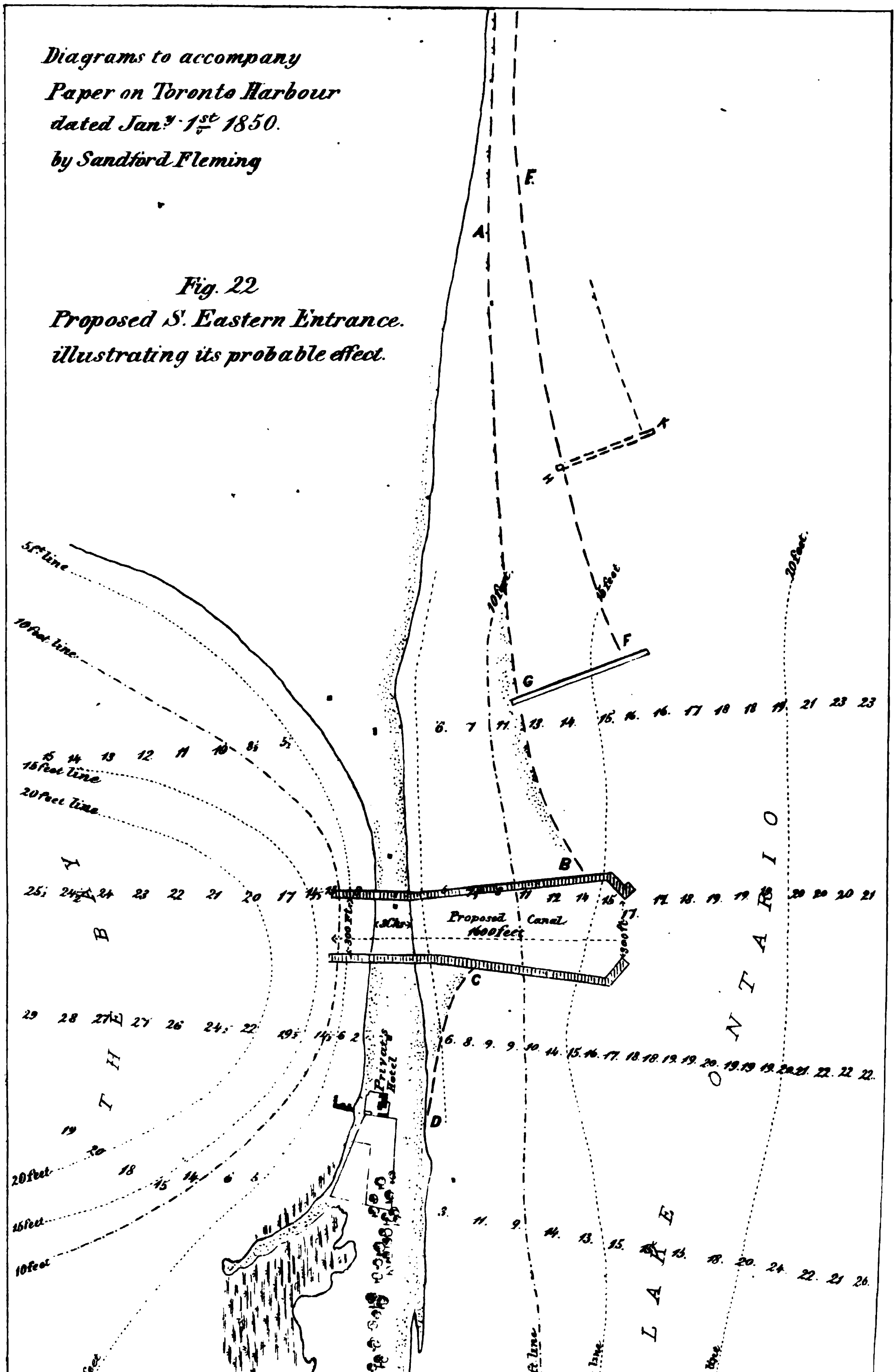


FIG 14
Present (1850) condition of Peninsula and Harbour.


Site of Toronto



For the Canadian Journal

[T]he Canadian Journal.

TORONTO, APRIL, 1854.

Meteors and Falling-Stars.

[...] the Canadian Institute, February 4th, by T. Henning, Esq.*

SHOOTING-STARS.

[Th]e important questions relating to shooting-stars, are [th]e size of the meteors, their infinitely greater frequency, [th]ey describe, their divergence or point of departure, [...]ent occurrence in showers, and the periodicity of cer[tain of th]ese phenomena. We can touch but very slightly upon [th]ese interesting points. Falling-stars are distinguished [by o]bservers into those that fall separately and in small [numbers, a]nd those that come in swarms or showers of many [...]. The former are said to fall *eporadically;* the latter [...] Arabian writers compare to swarms of locusts, are [...]n their visits and move in streams, generally in a [...]rection, proceeding from one or more points of diverg[ence ...]bers gives five or six as the mean number of meteors [...] be reckoned hourly in the range of vision of one per[son on ord]inary occasions; Quetelet gives eight. Julius Schmidt, [...]nn Observatory, an observer long accustomed to astro[nomical a]ccuracy, states in a letter lately written to Humboldt, [the m]ean number of *sporadic* shooting-stars observed in an [hour on o]rdinary occasions is from *four to five.* Of the *periodic* [...]here may be expected on the average in each hour [...]teen or fifteen. The most remarkable of the *periodic* [are t]hose which occur from the 12th to the 14th November, [and t]he 10th August, the festival of St. Lawrence, "whose [...]rs' were noticed in former times in a Church Calendar [...]d, no less than in old traditionary legends, as a meteo[ric] event of constant occurrence." Although several remark[able ...] on the night between the 12th and 13th November had [...]ed, such as the splendid one in 1799, described by Hum[boldt, an]d which had been seen in America from the equator to [He]rrnhut in Greenland (*Cosmos,* vol. iv., p. 216), also in [1]822, 1823, 1831, and 1832, still, the connection existing [...] these falls and the recurrence of certain days was un[...] of. The magnificent shower of 1833, when the stars [...]e flakes of snow," 240,000 having fallen during a period [...] hours, and was visible from Jamaica to Boston. Similar [...], of somewhat less intensity, were observed in the United [States i]n 1834, 1835, and 1836, of which very interesting accounts [...]n in the 27th, 29th, and 31st volumes of *Silliman's Jour[nal ...]* Olmsted and Palmer, of Yale College, who were perhaps [...] to detect the periodical character of this fall. The next [ce]lebrated fall is that of the 10th of August. The frequency [of mete]ors in the month of August was noticed by Muschenbroek [...]y as 1762, but their periodic return about St. Lawrence's [...]was first shown by Quetelet, Olbers, and Beuzenberg. [...]l other periods, however, have since been added to this [...]r, making the list stand thus:—

[JANUA]RY: between the 1st and 3rd. (Somewhat doubtful.)

[APRI]L: 18th or 20th. (?) (Arago was the first to call attention to this [...]as a recurring phase. Great streams: 25th April, 1095; 22nd April, 1800; 20th April, 1803.—*Cosmos,* vol. i., p. 125–6.)

MAY: 26th. (?)

JULY: 26th to 30th. (Quetelet: maximum properly between the 27th and 29th July.)

AUGUST: 10th. (Muschenbroek and Brandes.)

OCTOBER: 16th to 18th, according to Professor Lowe; 19th, and the days about the 26th, says Quetelet.

NOVEMBER: 12th to 14th; very seldom the 8th or 10th.

DECEMBER: 9th to 12th; but in 1798, according to Brandes' observation, the 6th and 7th; Herrick, in New Haven, 1838, the 7th to 8th; Heis (Aix la Chapelle), 1847, the 8th and 10th.

Eight or nine epochs of periodic meteoric streams are thus recommended to the attention of observers.

The *hourly variation* in the number of stars observed to fall during the night is a very remarkable thing, and one very difficult to account for. A very important paper upon this point was presented lately to the Institute at Paris, by M. de Coulvier Gravier, a plain country gentleman, who has devoted thirteen years to the study of falling stars, with the view principally of being able to predict therefrom the changes in the atmosphere. By the advice of M. Arago, he commenced in 1840 to keep a journal, which, by the personal co-operation of the celebrated astronomer Saigney, has been rendered a valuable acquisition to astronomical science. From 1841 to 1845, 5312 shooting-stars were observed in 1034 hours. An analysis of these observations prove that they appeared, with slight exceptions, in increased numbers as the night advanced towards morning. The number seen hourly stand thus:

From 6 to 7 o'clock, p. m		3·1
" 7 to 8	" "	4·5
" 8 to 9	" "	3·7
" 9 to 10	" "	4·10
" 10 to 11	" "	4·5
" 11 to 12	" "	5·0
" 12 to 1	" a.m.	5·8
" 1 to 2	" "	6·4
" 2 to 3	" "	7·1
" 3 to 4	" "	7·6
" 4 to 5	" "	6·0
" 5 to 6	" "	8·2

His observations between the 10th and 11th August, 1853, correspond with this. The hourly number of stars seen by him on the 9th was 49, and on the 10th 56. Between 9 and 10 o'clock p.m. on the 9th he saw 36, but between 1 and 2 a.m. 56. Between 12 and 1 o'clock on the night of the 10th–11th, 78 were seen, and 88 from 1 to 2. The direction was quite uniform, the radiant being near Cassiopeia. Mr. Herrick, at New Haven, on 10th August, 1853, saw from 12 to 3¼ o'clock, 388 stars, being 110 from 12 to 1, 115 from 2 to 3, and 44 from 3 to 3·25. Apparent radiant place did not change its position among the stars. Another result of M. Gravier's tables is the fact that the light of the moon does not efface more than three-fifths of the aggregate number of the stars thus seen. Again: while shooting stars appearing in the north of the hemisphere are not so numerous as those from the south, it is the same with the stars from the west as compared with the abundance of their appearance in the east. M. Gravier also ascertained that those stars comprised between the N.N.E. and the N.E. make the longer mean course, viz., 11°3′, while those between the S.W. and W.S.W. take the shortest mean course, viz., 11° 30′.

With regard to the point of divergence it may be necessary to state a few facts, as on this has been grounded an argument for

* Continued from page 191.

their being luminous bodies which present themselves independently of the earth's rotation, and penetrate into our atmosphere *from without*—from space. The observations of Olmsted proved that in the case of the November falls in 1832, 1834, and 1837, the stars proceeded from the star γ Leonis, but in the August fall in 1839, Algol in Perseus, or a point between Perseus and Taurus, was the centre of divergence. According to the accurate observations of Heis, at Aix la Chapelle, as quoted in Vol. I. of the *Cosmos*, "The falling-stars of the *November period* present the peculiarity that their paths are more dispersed than those of the *August period*. In each of the two periods there were simultaneously several points of departure, by no means always proceeding *from the same constellation*, as there was too great a tendency to assume since the year 1833." After investigating the paths of 407 stars, he found that 171 came from Perseus, 83 from Leo, 35 from Cassiopeia, 40 from the Dragon's Head, but full 78 from undetermined points. Schmidt, of Bonn, in a letter to Humboldt (July, 1851), says: "If I deduct from the abundant falls of shooting-stars in November 1833 and 1834, as well as from subsequent ones, that kind in which the point in Leo sent out whole swarms of meteors, I am at present inclined to consider the *Perseus point* as that point of divergence which presents not only in August, but throughout the *whole year*, the most meteors. This point is situated in Right Ascension 50·3°, and Declension 51·5° (holding good for 1844–6.") He adds, "If the directions of the meteor-paths are considered in their full complication and periodical recurrence, it is found that there are certain *points of divergence* which are always represented, others which appear only sporadically and changeably."

THEORIES REGARDING THE ORIGIN OF METEORITES AND FALLING-STARS.

Passing over the opinions of those who attributed *meteorites* to the effect of lightning in tearing up the earth and converting it into a compact mass, of Aristotle, who considered them masses of stone carried by a hurricane from one locality to another, and of those who have supplied that mysterious region, the North Pole, with an enormous volcano, hurling its eruptions to the distance of many hundred miles, the hypotheses regarding their origin may be reduced to three: 1st. that which makes them of atmospheric origin; 2nd. that which gives to them a lunar or planetary origin; and lastly, that which is now generally received as the true one, viz, that they are of cosmical origin.

The hypotheses respecting the atmospheric origin of these bodies are now generally exploded; and yet a great deal can be said in their favour. The ablest and most satisfactory paper upon this subject that I have been able to procure, is one written by F. G. Fischer, Esq., in the Berlin *Memoirs*. It is too long, and discusses too many points, to admit of the compression suitable to a paper like this. He lays down his positions something to this effect: Owing to the many gases and exhalations which are continually evolving at the surface of the earth, many matters exist in the atmosphere which escape chemical investigation, either from the want of tests to denote their presence, from their extreme rarity, or from their accumulating only in the higher regions of the atmosphere, where no experiments can be made. Owing to their extreme lightness, these exhalations ascend with the rapidity of lightning immediately on being disengaged, commingling only when they reach a stratum of air of equal rarity. What becomes of these vapours and gases, which, in the lapse of ages, must be greatly augmented? "Perhaps," says Mr. Fischer, "falling-stars, fire-balls, northern lights, and meteoric stones are the means by which Nature either transforms them into her own essence or returns them directly to the earth." In the reduction of these gases to solids, he has recourse to the agency of electricity, but the *modus operandi* he attempts not to explain. Kepler held somewhat similar views, and describes fire-balls and shooting-stars as "meteors arising from the exhalations of the earth, and blending with the higher ether." Sir William Hamilton, while giving an account of the great eruption of Vesuvius, in August, 1799, ascribes such phenomena to local electrical agency, developed by volcanic ejections. "This kind of electrical fire," says he, "seems to be harmless, and never to reach the ground." (On the improbability that meteoric masses are formed from metal-dissolving gases, which, according to Fusimeri and others, may exist in the highest strata of our atmosphere, and, previously diffused through an almost boundless space, may suddenly assume a solid condition, and on the penetration and misceability of gases, Humboldt treats largely in his *Relation Historique*, vol. i., p. 525.)

ORIGIN IN LUNAR VOLCANOES.

Another opinion is, that aerolites derive their origin from volcanoes in the moon. Chladni states that an Italian, Paolo Terzago, was the first to surmise (1664) that these bodies were of selenic origin. In 1795 Olbers commenced an investigation into the amount of the initial tangential force that would be requisite to bring to the earth masses projected from the moon; and the mathematical possibility of a sufficient force existing, together with the then prevalent opinion of there being active volcanoes in the moon, led to the belief in some minds of the physical probability of such an origin. La Place, Biot, Brandes, and Poisson all gave considerable attention to this *ballistic* problem, as Humboldt designates it. Olbers, Brandes, and Chladni thought "that the velocity of 16 to 32 miles, with which fire-balls and shooting-stars entered our atmosphere," furnished a refutation to the view of their selenic origin. Setting aside the resistance of the air, an initial velocity of 8292 feet in a second would be required, according to Olbers; to La Place, 7862; to Biot, 8282; and to Poisson, 7595. Olbers has shown "that, with an initial velocity of 8000 feet in a second, meteoric stones would arrive at the surface of the earth with a velocity of only 35,000 feet. But the measured velocity of meteoric stones averages five times that amount, or upward of 114,000 feet to a second, and, consequently, the original velocity of projection from the moon must be almost 110,000 feet, or fourteen times greater than La Place asserted." —(*Cosmos*, vol. i., p. 121.)

La Place, in one portion of his great book, cautiously observes that aerolites, "in all probability, come from the depths of space," but elsewhere inclines to the hypothesis of their lunar origin—assuming, however, that the stones projected from the moon "become satellites of our earth, describing around it more or less eccentric orbits, and thus not reaching its atmosphere until several, or even many revolutions have been accomplished." The distinguished chemist Berzelius has examined this hypothesis at great length, and adopts it on grounds which he finds in the chemical constitution and mineralogical character of these bodies. His arguments, which are copied in the Edinburgh new *Philosophical Journal*, are exceedingly ingenious, but still they are built on hypothetical conjectures which can be met and answered. Von Ende Beuzenberg and others coincide in his general views. The great velocity of these bodies, however, as well as the direction of their orbits, which is often opposite to that of the earth, are now regarded as conclusive arguments against this hypothesis. In connection with this, I may just name the opinion of Olbers and those who consider these meteoric bodies the *debris* or fragments of a large planet which had burst, and of which the *asteroids* are the remaining portions. The smaller fragments continue to circulate about the sun in orbits of great eccentricity, and when they

approach the regions of space through which the earth is moving, they enter the atmosphere with great velocity, and in consequence of the great resistance and friction which follow, are rendered incandescent, and emit a light as long as they remain in it. As there have thus been believers in the planetary origin of meteorites, so some of the Greek philosophers thought they came from the sun. This was the opinion of Diogenes Laertius regarding the origin of the Aegos Potamos stone, about which Aristotle held such an absurd idea.

COSMICAL ORIGIN OF AEROLITES, ETC.

The more general opinion now is that the greater portion of meteors are of *cosmical* origin—that is, bodies revolving in space, independent of the earth's rotation, and subject to the same laws as the other celestial bodies. "Shooting-stars, fire-balls, and meteoric stones are," says Humboldt, "with great probability, regarded as small bodies moving with planetary velocity, and revolving, in obedience to the laws of general gravity, in conic sections round the sun. When these masses meet the earth in their course, and are attracted by it, they enter within the limits of our atmosphere in a luminous condition, and frequently let fall more or less strongly heated stony fragments, covered with a shining black crust; but the formative power, and the nature of the physical and chemical processes involved in these phenomena, are questions all equally shrouded in mystery."

The great argument in favor of this view of the character of these bodies is derived from the divergence or point of departure being generally stationary, and secondly, from their entirely planetary velocity. These facts led Sir John Herschell to decide "that a zone or zones of these bodies revolve about the sun, and are intersected by the earth in its annual revolution." Capocci, of Naples, regards the Aurora Borealis, shooting-stars, aerolites, and comets as all having the same origin, and as resulting from the aggregation of cosmical atoms, brought into union by magnetic attraction. He supposes that in the planetary spaces there exist bands or zones of nebulous particles, more or less fine, and endued with magnetic forces, which the earth traverses in its annual revolution; that the smallest and most impalpable of these particles are occasionally precipitated on the magnetic poles of our globe, and form polar Auroras; that the particles a degree larger, in which the force of gravitation begins to be manifested, are attracted by the earth, and appear as shooting-stars; that the particles in a more advanced state of concretion give rise in like manner to the phenomena of fire balls, aerolites, etc.; that the comets which are known to have very small masses are nothing else than the largest of the aerolites, or rather uranolites, which, in course of time, collect a sufficient quantity of matter to be visible from the earth.

After the great shower of stars in 1833, and the observed periodicity of its character, Professor Olmsted, collecting all the facts within reach, deduced from them the existence of a nebulous cloud or mass of meteoric stars, approaching the earth at particular periods of its revolution, under conditions as to time, direction, and physical changes from proximity, which he has fully detailed in Silliman's *Journal of Science* for 1834 and 1836. His speculation that this meteoric cloud might be part of the solar nebula known as the Zodiacal Light, was taken up and enlarged upon by Biot in a Memoir read by him in 1836. He shows that on the 13th November the earth is in such a relative position that it must necessarily act by attraction or contact upon the material particles of which this nebula is composed, producing phenomena which we may reasonably consider to be represented by these meteoric showers. He brings the same theory to explain the sporadic shooting-stars of ordinary nights. He supposes, that the habitual passage of Mercury and Venus across the more central regions of this nebula must have dispersed innumerable particles in orbits very little inclined to the ecliptic, and so variously directed that the earth may encumber, attract, and render them luminous in every part of its revolution. Supposing, then, we admit that these meteors compose a closed ring or zone, within which they all pursue one common orbit, how is it that we so seldom witness such splendid spectacles as those exhibited in the November showers of 1799 and 1833? "If," says Humboldt, "in one of these rings, which we regard as the orbit of a periodical stream, the asteroids should be so irregularly distributed as to consist of but few groups sufficiently dense to give rise to these phenomena, we may easily account for the unfrequency of such glorious sights." Olbers has predicted, but I know not upon what data, that the next appearance of the phenomenon of shooting stars and fire-balls intermixed, falling like flakes of snow, will not occur until between the 12th and 14th November, 1867.—(*Cosmos*, vol. i., p. 127.) Again: the enormous swarm of falling-stars in November, 1799, was almost exclusively seen in America—the swarms of 1831 and 1832 were visible only in Europe, and those of 1833 and 1834 only in the United States, and occasionally the November stream has been visible in but a small portion of the earth. A very splendid meteoric shower was seen in England in 1837, while a most attentive and skillful observer at Braunzberg, in Prussia, only saw on the same night, which was uninterruptedly clear, a few sporadic shooting-stars, between 7 o'clock p. m. and sunrise the next morning. Bessel explains, "that a dense group of the bodies comprising the great ring may have reached that part of the earth in which England is situated, while the more eastern districts of the earth might be passing at the time through a part of the meteoric ring proportionally less densely studded with bodies." In the same way Humboldt accounts for the non-appearance, during certain years, in any portion of the earth, of the two great streams of August and November, to intervals occurring between the asteroid groups. Poisson's account of this is somewhat different. "If," says he, "the group of falling-stars form an annulus around the sun, its velocity of circulation may be very different from that of our earth; and the displacements it may experience in space, in consequence of the actions of the various planets, may render the phenomenon of its intersecting the planes of the ecliptic possible at some epochs, and altogether impossible at others." The latest form of this hypothesis is that adopted by M.M. Saigney and Gravier, in France, viz., that meteors and their substances have their original abode in infinite space; that large groups of shooting-stars are situated in portions of the heavens visited by our earth; that, when our globe arrives in the vicinity of these corpuscules, they are attracted by the earth, and, bursting, leave the material of which they are composed to fall upon the surface of our globe.

Whilst this is now generally regarded as the most probable hypothesis yet framed to account for the origin of these mysterious appearances, still, even by it, many things regarding meteors are left unsolved. Many questions there are yet awaiting the possible solution of the future, and this solution can only be the result of more extended observation and experiment. It is the duty, therefore, of all who desire the advancement of science, to aid in adding at least to the number of recorded observations, and thus to broaden the basis on which the astronomer and the man of science are to build their hypotheses and their theories.

In conclusion, it is remarkable to find that the opinions of some of the Greek natural philosophers, particularly those of the Ionian school, early assumed the *cosmical* origin of meteoric stones.

"Falling-stars," says Plutarch, in his life of Lysander, "are not emanations or detached parts of the elementary fire, that go out the moment they are kindled, nor yet a quantity of air bursting out from some compression, and taking fire in the upper regions; but they are really heavenly bodies, which, from some relaxation of the rapidity of their motion, or by some irregular concussion, are loosened, and fall." And Diogenes, of Apollonia, says: "*Invisible* (dark) masses of stone move with the visible stars, and remain, on that account, unknown. The former sometimes fall upon the earth, and are extinguished, as happened with the *stony star* which fell near Aegos Potamos."

The utilitarian spirit of the present age is apt to enquire after the practical uses to be attained by the observation of these celestial phenomena. On this point but little can be said. So far as I have been able to learn, the geographical determination of degrees of longitude is the only practical purpose which well-observed falls of shooting-stars have yet been made to subserve. Beuzenberg published a paper on this subject in 1802, but Dr. Maskelyne had pointed to this application of the phenomena some twenty years previously. In a letter dated Greenwich, Nov. 6, 1783, he writes: "If the exact time could be had at different places, the absolute velocity of the meteor, the velocity of the sound propagated to us from the higher regions of the atmosphere, and the *longitude of places* might be determined." (On this point, see *Silliman's Journal* for Oct., 1840.) But apart from this view of the matter, what deep interest attaches to meteoric phenomena, if we admit the connection that is now believed to exist between them and other planetary systems! "He who is penetrated with a sense of this mysterious connection (to adopt the fine sentiments of Humboldt), and whose mind is open to deep impressions of Nature, will feel himself moved by the deepest and most solemn unction at the sight of every star that shoots across the vault of heaven, no less than at the glorious spectacle of meteoric swarms in the November phenomenon, or on St. Lawrence's Day. Here motion is suddenly revealed in the midst of nocturnal rest. The still radiance of the vault of heaven is for a moment animated with life and movement. In the mild radiance left on the track of the shooting-star, imagination pictures the lengthened path of the meteor through the vault of heaven, while, everywhere around, the luminous asteroids proclaim the existence of one common material universe. Accustomed to gain our knowledge of what is not telluric solely through measurement, calculations, and the deductions of reason, we experience a sentiment of astonishment at finding that we may examine, weigh, and analyze bodies that appertain to the outer world. This awakens, by the power of the imagination, a meditative, spiritual train of thought, where the untutored mind perceives only scintillations of light in the firmament, and sees in the blackened stone that falls from the exploded cloud nothing beyond the rough product of a powerful natural force."

A few Rough Notes on some of the Canadian Saturniæ, and Suggestions on the Possibility of using their Silk for Textile Purposes.

Read before the Canadian Institute, March 11th, by Thomas Cottle, M.D. of Woodstock.

To the student of Nature, the delight which his investigations of the different kingdoms create is very much enhanced if, during his researches, he can discover among the natural productions of the country he inhabits any which may be usefully employed in adding to the necessaries or luxuries of life.

In the following trifling sketch, it is the wish to call attention to a genus of Lepidopterous insects whose products may possibly be as usefully employed as some of the coarser varieties of silk now used in India, and which, being indigenous, would not be liable to the failure that occurred some years ago in the attempt to introduce the true silk worm into the neighbouring States of the Union. Should this expectation not be realized when tested by experiment, yet, if the hint now given should induce others to turn their attention to the as yet comparatively unexplored productions of this Province, they will not have been written in vain.

To the family Bombycidæ belong those moths the enveloping tissues of whose cocoons have been used for textile purposes. The member of this family the products of whose labour have been most used by man, and to whose silk it is generally thought we are entirely dependant for our silken fabrics, is the well-known silk-worm *par excellence* (Bombyx mori), with which all are too cognisant to require further mention; but in India the web of other insects of this family are so employed. On this subject, Cuvier, or rather Latreille, in the Regne Animal, writing of the genus Saturnia, says: "They have employed from time immemorial in Bengal two other species of the same division, the Bombyx Mylitta, of Fabricius, and the Phalæna Cynthia, of Drury, and I am convinced, after the communication made me by M. Huzard of a Chinese manuscript on this subject, that the caterpillars of these Bombyces were the wild silk-worms of China, and I think that a part of the silks which the ancients procured by their maritime commerce with the Indies was produced from the silk of these worms." Both the insects above mentioned belong to the genus Saturnia as now constituted. Some of the Canadian species are very fine specimens of the genus, and spin large cocoons; and is it unreasonable to imagine that one or other of the species might be made as available for manufacturing purposes as their Indian congeners? An obstacle to be overcome is the difficulty of dissolving the animal cements with which the caterpillar glues together the threads; but as the perfect insect has the power of dissolving this glue when about to escape from its cocoon (for it has no jaws to tear open the walls of its prison), could not the chemist, by analyzing this fluid there secreted, provide us with an efficient solvent? The natives of India for one species use a lye made of the ashes of the plantain.

The first is Saturnia Polyphemus, one of the princes of the Canadian Lepidoptera: This fine insect expands five inches, is of a yellowish brown; both wings with a hyaline spot. The anterior wing is marked with two curved lines near the base, a waved line on the border, and a dark spot on the apex. The hyaline spot is encircled by a yellow margin. On the posterior wing the hyaline spot is larger, with a bluish grey iris, shading into black, and the marginal band is darker. The colours of the male are the same as those of the female, but more decided. The caterpillar is described by Gosse "as of a most brilliant light green, nearly transparent, each segment of the body rising into two roundish humps, each ending in a little bright yellow tubercle, bearing two or three short hairs; two rows of similar tubercles run down each side, which are joined by a diagonal yellow line on each segment, just behind which are the spiracles, which are scarlet. The head and legs are light brown, the last segment terminated by a line of purplish brown. It is rather inactive, and slow of motion. Its length, when crawling, is two inches and a half, and its diameter about half an inch." He gives it as feeding on the choke cherry (Prunus Serotina), and probably any species of Prunus will serve it for nourishment. The cocoon

is oblong, rounded at the ends, and very firm, capable of resisting considerable pressure, and in all those examined, with the leaves of one or other species of Prunus firmly attached. Its weight is about eleven grains. This insect bears considerable resemblance to the Saturnia Mylitta of India, one of those species which are there cultivated for their silk, and which goes there by the name of Tusseh silk. The natives are unable to rear these in confinement, and trust to the eggs of wild individuals for their annual supply of caterpillars. We may probably have the same difficulty with the Canadian species. The writer, during the last summer, raised a female, which, soon after leaving the cocoon, began laying unimpregnated eggs. He procured a male, which he placed in the same box, but, though left together for three or four days, no connection took place. Whether the female was exhausted before the introduction of the male (though it still continued to lay a few eggs), or whether, like the Indian species, they will not breed in confinement, requires further experiment. The silk of this species is of a lighter colour than either of the two following, not very much darker than that of the Bombyx Mori.

The Saturnia Cecropia is another of the silk-spinning moths. This is the largest of the Canadian Lepidoptera, and in fact is inferior in size to but few of the family. It varies from six to seven inches in width. Its head is red, with a white collar between it and the thorax, which, with the abdomen, is red. The latter is marked with white transverse lines; the ground colour of the wings is greyish brown; the base of the anterior pair same colour as the thorax, bounded anteriorly by a whitish band; disk oblong, rusty brown, with a kidney-shaped white spot margined with black; beyond this, a brown wavy band bordered with black, the rest of the wing shading down to light brown, with indented black line. Near the tip is a black spot, with a crescentic line of light blue; the colour of the posterior wing the same; the oblong disk larger, and marked with the same white spot. The ferruginous band is broader, bordered with white, before which is a transverse row of black spots, and a black transverse line. The caterpillar is green, with several projecting points, which, as well as the head and legs, are yellow. On each segment are two small blue spots. It does not confine itself to one species of plant for food. Abbot says it feeds on the wild American plum (Prunus Pennsylvanica). Here the apple seems its favourite food. It also feeds on a species of Spiræa, common on the borders of swamps. The writer has taken a cocoon from a common garden plum, and from a bitter nut (Carya Amara); but finding an occasional cocoon on a tree is not a proof that on that tree the insect has fed, for the caterpillar will crawl some distance occasionally for a convenient situation. An individual which, for the ease of observation, was fed on one of the above mentioned low shrubby Spiræas, when about to change into the pupa, ascended a maple ten or fifteen feet from the plant on which it was nourished. The cocoon is firmly attached to the under side of a twig. It is three inches in length, and of a brown colour. The outer layer is coarse and strong; the inner finer. It weighs about seventeen grains.

Saturnia Promethea is much more common than the preceding one. The male insect is of a dark, chocolate brown, nearly black. The margins of both wings are light brown, with a deeply indented wavy black line. Near the apex of the anterior wing is a black spot, with a semicircular blue margin on the posterior wing. Within the black line are several black spots. The female differs very much from the male, so much so as to be hardly recognizable as the same insect. The wings are not falcate, but rounded; the whole body of a reddish brown; the colour of both wings is the same; the interior half is a dark brown, the remainder much lighter, with minute black specks, looking as if powdered, and a dark buff margin. On the anterior wing is an angular white spot. The spot on the apex like that in the male. On the posterior wing is a lunated white mark; on the hinder margin a wavy line, within which are reddish brown spots.

Peale describes the caterpillar as of a delicate green, with yellow feet. Each segment of the body, except the posterior, is marked with six blue spots, from which arise small black tubercles. In the second and third segments however, the two central tubercles are replaced by club-like projections of a third of an inch in length, and of a bright coral-red colour. The last segment is furnished with but few tubercles, the central one of which is of the same clavate form as those on the anterior segments, but of a yellow colour. When about to change into the pupa state, it selects a leaf, the sides of which it draws together by means of its silk, which it continues over the petiole to the branch, round which it firmly fastens it. Within the leaf it then spins its cocoon, and retires for the winter, during which time the leaf and its footstalk wither, and are carried away by the blast, leaving the cocoon hanging by its peduncle, and, to a casual glance, looking like a withered leaf. On tearing off the outer layer which originally lined the leaf, and which is very strong, an oblong cocoon remains, about the size of that of the silk-worm, of a dark brown colour, and very firm. The perfect insect appears in June. This insect seems as indifferent in the choice of its food as the last species. Abbot figures it on the Halesia Tetraptera. It feeds on the spice-wood (Laurus Benzoin), the sassafras (Laurus Sassafras), and the common wild cherry. In this part of Canada the last is the favourite food.

Another species, the Saturnia Luna, the most beautiful, though not the largest of our native Saturniæ, judging by analogy, would also furnish silk; but from its rarity, none of its cocoons have come under observation.

Of the insects above mentioned, their usefulness will probably be in the order of their enumeration. The Saturnia Polyphemus, though rarer, spins a considerable quantity of silk, and will be most easily unwound. The Saturnia Cecropia, although the largest and more frequent, at least in this locality, has coarse silk, which will probably require to be torn in shreds and carded as cotton or wool. Saturnia Promethea is by far the most common, but will probably be the most difficult to use, the cocoon being very firmly glued together.

Remarks on some Coincidences between the Primitive Antiquities of the Old and New World.

By Professor Wilson, LL.D. University College, Toronto.

In introducing this subject to the members of the Canadian Institute, Professor Wilson observed:—

It is well known to the students of antiquities, in so far as such relics of the past are valuable to us for the purposes of historical illustration, that the archæologists of Europe have of late years devoted much of their study to those remains which pertain to epochs older than the classic ages, and to areas lying beyond the ancient limits of Greece and Rome. In this study of the primitive antiquities of Europe, Scandinavian and British archæologists have taken the foremost place, and the result has been the disclosure of traces, throughout the North of Europe and the British Isles, of the extremely rude and primitive arts and sepulchral rites of a people occupying these areas long prior

to the dawn of history, or to the intrusion of even the oldest of the historic races on regions from which they were being displaced, or had already disappeared, at the early dates when the first glimpses of transalpine Europe are met with in the pages of Greek or Roman historians. The recent investigations of the archæologist and philologist, though pursued on entirely different grounds, and with little concurrent aim or purpose, alike disclose the fact that there have existed on the Continent of Europe races entirely distinct from the great historic group to whom the Indo-Germanic languages pertain; and while the philological investigations of Dr. Pritchard have extended this group so as to embrace the Celtic languages, and convert the whole into a more comprehensive Indo-European classification, the researches of Nilsson, Retzius, Worsaae, and their British coadjutors, appear no less conclusively to establish the fact that the ancient Keltai were intruders on still older Allophylian races.

It is probable that some of the results of such investigations are already familiar to members of the Canadian Institute, especially as the labours of Scandinavian antiquaries, to whose researches some of the most valuable results are due, have acquired a special interest for the colonists of this Western World since the recent publication of the "*Antiquitates Americanæ*" has by the Society of Antiquaries of Copenhagen, added upwards of three centuries to the historic era of the continent re-discovered by Columbus. To others, however, a reference to such archæological investigations may not be without novelty as well as interest. It had long been known to antiquaries that, along with the relics of classic art, there were also to be found throughout Europe monolithic structures, fictile ware, and weapons and implements of stone, copper, and bronze, the manifest productions of ruder artificers than even the legionary artizans of Imperial Rome. These, when they attracted any attention, were loosely designated as "aboriginal" or "Celtic," and were supposed to receive a sufficient classification by being thus set apart from the classic remains, which were alone thought worthy of careful study. During the present century, however, the archæologists of Northern Europe have devoted special attention to such traces of aboriginal arts and primitive civilization, and the result has been the classification of their various sub-divisions on principles of scientific chronological order and logical analogies, akin to those by which the palæontologist has reduced to order and method the older chaos of unsystematized and uninterpreted geology.

The first class in this system of primitive archæology is designated "*the Stone Period*," as embracing the European era of rudest aboriginal arts, during which the necessities of war and the chase, and of the simple domestic economy of its ancient people, were supplied by weapons and implements constructed entirely of such ready natural materials as stone, horn, bone, etc.

After referring to the abundant evidence of the existence and duration of such an era of primitive savage arts in Europe, as is proved by collections including many thousand specimens in European Museums, Professor Wilson next proceeded to show the remoteness of the era to which they belong, as demonstrated by the circumstances under which some of them have been found. In proof of this he referred, among other examples, to the discovery in the alluvial valley of the River Forth, in Scotland, at different periods from 1819 to 1824, of gigantic fossil balænopteræ, at heights varying from twenty to nearly forty feet above the present level of the sea; and while the situation of such cetaceous fossils manifestly proved a gain of dry land from the sea, and that not by the filling up of the ancient estuary, but by the upheaval of the whole area, the discovery along with them, in more than one instance, of the rude bone lance or harpoon by which it may be presumed they had been assailed by some hardy Caledonian whaler of the remote era which they reveal, no less conclusively establishes the fact that such changes must have occurred since the British Islands were occupied by a human population. He then drew attention to the well ascertained examples of the upheaval of large areas within the historic period, apart from such instances of active volcanic action as Puzzuoli and other parts of the Bay of Baiæ, in Italy, exhibit. Special reference was made to the ascertained rate of upheaval still going on over a large portion of the Scandinavian peninsula, extending from Gothenburg to the head of the Gulf of Bothnia, if not indeed to the North Cape, and from this he inferred that the evidence of the colonization of the British Isles pointed to a date, at the very lowest computation, of some fifteen centuries before the Christian era.

At a period thus approximately defined, the primitive races of Northern Europe and the British Isles were practising arts precisely analogous to those with which we are familiar on this continent, as still pursued among its rude aboriginal tribes. At a later period, as appears from the investigations of European archæologists, the metallurgic arts were introduced among the primitive tribes of the Old World, and implements and weapons of copper and of bronze gradually displaced their ruder stone predecessors. Such would appear to have been the common experience of the untutored races of mankind, for no primitive and barbarous people has been met with in modern times, cut off from intercourse with civilized nations, among whom any knowledge of the metallurgic arts existed; and no partially civilized people, when similarly isolated, appears to have acquired the art of smelting and working the iron ore. The Esquimaux, and the whole natives of the Polynesian Islands, were, when first discovered, in precisely the same condition as the Allophylian races of Europe duing its Stone Period. They were without any knowledge of the metals, and supplied all their wants by means of implements of stone, shell, bone, and wood. Such also was the condition of the Indians of North America when first brought into contact with Europeans. Nor is this conclusion affected by such discoveries of mining operations as those referred to in Mr. Whittlesey's paper on the Ancient Mines of Lake Superior.* In so far as any traces of the employment of their products, either by the Indians or by the mound-builders of an older era, have been recovered, they prove the extremely primitive and untutored arts of both races, while amply bearing out the justice of that writer's observations that "the copper is apparently *cold wrought*, and does not show that it has been melted. It must, therefore, have been found by the mound-builders in its native state, and there are no mines in North America known at this time from which native metal can be had except those of Lake Superior."

Such a process of working the malleable ores has already been recognised as far too partial a manifestation of any knowledge of the properties of metals to be accepted in proof of the introduction of the metallurgic arts among a people. It has been remarked, in reference to similar specimens of "*cold wrought*" metallic relics:—"It is not impossible that the working in gold may have preceded even the age of bronze. If metal could be found capable of being wrought and fashioned without smelting or moulding, its use was perfectly compatible with the simple arts of the Stone Period. Of such use masses of native gold, such as have been often found both in the Old and the New

* *Canadian Journal*, Vol. I., p. 132.

World, are peculiarly susceptible; and some of the examples of Scottish gold personal ornaments fully correspond with the probable results of such an anticipatory use of the metals."*

The metallurgic arts were, however, introduced into Northern Europe at a period prior to the dawn of authentic history, but now designated, from the remains of its novel arts, "*the Bronze Period;*" and America had its corresponding ante-historic era, during which the metallurgic arts of Mexico and Yucatan were developed among a people to all appearance of the same race as the mound-builders of the Mississippi Valley, and, like them, totally ignorant of the more laborious and difficult art of smelting and forging the iron ore.

Professor Wilson having pointed out, somewhat in detail, the great similarity observable between the stone, bone, and horn implements and weapons of the American Indians and those found in the ancient sepulchral barrows of Northern Europe, and also the analogies between the copper tools and weapons of the mounds of the Mississippi Valley and the copper and bronze relics of Europe's pre-historic period: concluded by remarking that it must be regarded as a subject of just interest thus to perceive that aboriginal races, had been displaced by the historic races from the ancient area of Europe, equally rude in their arts, and low in the scale of civilization, with those whom the philanthropist and the scientific observer now watch with a common regret disappearing before the advances of the European on this great continent, like the dews of morning before the rising sun.

On some New Genera and Species of Cystidea from the Trenton Limestone.

Read before the Canadian Institute, February 11th, by E. BILLINGS, *Barrister at Law, Bytown, Canada West.*

The Cystidea were first set apart as a separate order of the Echinodermata by the late illustrious geologist, Leopold Von Buch, in a memoir which appeared in 1845 in the Transactions of the Royal Academy of Sciences of Berlin, and afterwards in 1846 translated and published in the Journal of the Geological Society of London. From the latter publication the following definition of the order is extracted:

"The CYSTIDEA were natural bodies supported on a stem or pedicle, which was attached to the ground; their surface, more or less spherical, was covered by a great number of polyhedral plates, accurately fitted to one another, and between these plates were certain openings, necessary for the performance of the animal functions.

"With regard to the openings on the surface, we find in all the Cystidea, 1st, that the mouth was planted in the central part of the upper surface, generally in a moveable proboscis covered with minute plates; 2nd, that besides this mouth, and close to it, there is generally, if not always, a small anal orifice penetrating the plate, but not itself surrounded with any plates peculiar to it; 3rd, that further towards the middle, but almost invariably on the upper half of the body on which the mouth is placed, there rises a round or oval aperture, not connected with the mouth, and often covered by a five or six-sided pyramid, which seems to be composed of as many little valves. This probably forms the ovarial orifice of the animal."—*Quarterly Journal, Geological Society,* vol. ii., p. 29.

Von Buch also supposed that the Cystidea were not provided with arms similar to those of the Crinoidea, but since the date of his monograph several species have been brought to light furnished with appendages which may be called arms. These, together with certain other organs supposed to be peculiar to this group, will be referred to hereafter.

The Cystidea are rare fossils, and as yet but imperfectly understood in some respects. Von Buch, in the article above quoted, describes seven species known in 1845 on the continent of Europe, and in 1848 Professor E. Forbes, in the Memoirs of the Geological Survey of England, gave an account of twenty-one species discovered in the Silurian rocks of Great Britain. Of these, two were found to be identical with *Spheronites aurantium* and *Caryocystites granatum*, also described by Von Buch, while several others were mere fragments, recognised to be portions of Cystideans. It is probable that in all Europe not more than thirty species had been clearly established in 1848.

The American species already made known are only seven. They are the following:

1st. A fossil found at Bytown many years ago by Dr. Bigsby, and described by Mr. G. B. Sowerby in Vol. II. of the Zoological Journal, p. 318. Professor E. Forbes refers this curious organism to the genus *Agelacrinites* of Vanuxem.

2nd. *Echino-encrinites anatiformis*, in Vol. I. of Hall's Palæontology of New York. This species and the former are the only Cystidea yet described as having been discovered in the Trenton limestone. It has been found by Mr. Logan in Lower Canada, and in Owen's Report on the Geology of Wisconsin, p. 505, it is said to have been met with in the upper magnesian limestone of that region, a formation classified as the equivalent of the Trenton limestone.

3rd. *Callocystites Jewettii.*

4th. *Apiocystites Elegans.*

5th. *Hemicystites Parasitica.* The three last are from the Niagara shale, and described in Vol. II. of the Palæontology of New York.

6th. *Lepadocrinites Gebhardii*, from the Pentamerus limestone, figured but not described at p. 346 in Mather's Report on the Geology of the First District of New York.

7th. *Agelacrinites Hamiltonensis*, from the Hamilton group, noticed in Vanuxem's Report on the Geology of the Third District at p. 158, and figured at the end of the volume.

I now propose to add to the above list of American Cystidea several new species discovered by me within the last two years in the Trenton limestone at Bytown and in the immediate vicinity. The first of these, as it constitutes a new genus, may be called Glyptocystites, on account of the profusion of sculpture with which its surface is ornamented. Its description is as follows:

GENUS GLYPTOCYSTITES. *(Nov. gen.)*

[Greek, γλυπτος, *sculptilis*, and κυστις, *vesica.*]

Body oblong, composed of four horizontal, irregular series of plates, so disposed as to form five nearly vertical pillars, each of which supports an arm; pelvic plates, four; second, third, and fourth series of five plates each, summit closed by several small pieces; arms originating from the top of the fourth series, deflected downwards, and attached to the sides throughout their whole length; a sinuated groove, terminating upwards in the mouth, occupies the centre of each arm; a row of tentacles on each side of each groove, mouth situated in the apex, and closed by a valvu-

*Wilson's *Pre-historic Annals of Scotland*, p. 214.

lar apparatus of small plates; anal orifice on the left side, near the mouth; ovarian aperture in the lower half of the body, *without valves;* column short, and tapering to a point downwards; pectinated rhombs on many parts of the body.

But one species is known, which is the following:

Glyptocystites Multipora.

DIAGRAMS OF THE STRUCTURE AND ARRANGEMENT OF THE PARTS.*

Fig. 1. *Left side.* Fig. 2. *Postal side.* Fig. 3. *Right side.* Fig. 4. *Antal side.*

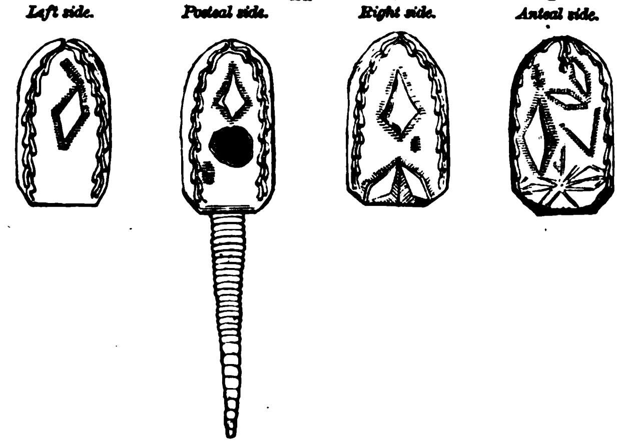
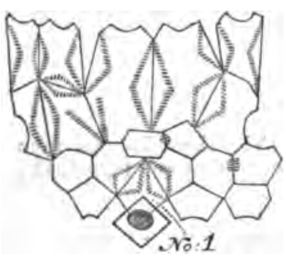
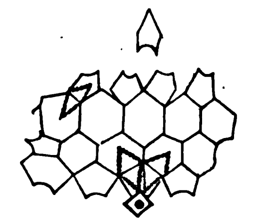


Fig. 5.



Development of the plates and pores of of *Glyptocystites multipora.*

Fig. 6.



Development of the plates and pores of *Sycocystites* (Echino-encrinites) *angulosus*, as drawn by Von Buch.

—*Quarterly Journal, Geographical Society, Vol. II., Plate* 4.

This beautiful little fossil is about one inch long, and five-eighths of an inch in its greatest diameter. Some of the specimens are larger, but these appear to be the average dimensions. The body is of an oblong and slightly conical shape, most obtuse at the base. It is also obscurely five-sided, the arms being situated upon the angles. Its covering consists of a number of polyhedral plates, firmly united at their edges, and forming a strong calcareous shell, which, if fissured down from the top to the bottom, and unfolded on a plane surface, would present the arrangement seen in Fig 5.

In the several other genera of Cystideans allied to this, the rows of plates extend in uninterrupted bands horizontally round the body, but here the second and third rows are broken through by the extension of the plates in the series below and above.

In the basal series there are four plates resting upon the upper joint of the pedicle, one of them hexagonal, and three pentagonal. The hexagonal plate occupies the base on the posterior side, and supports that plate on which rests the ovarian aperture; and the pentagonal plate, immediately opposite on the front side of the fossil, is remarkable for being twice the height of the others. As allusion will be frequently made to it in the course of the following description, it is marked No. 1 in the diagram Fig. 5, for convenience of reference.

The second series consists of five plates, three hexagonal, and two slightly heptagonal. This row is divided in front by the great extension upwards of No. 1. The ovarian aperture rests in a concave notch excavated out of the upper side of the plate in this series, which is supported by the hexagonal pelvic plate. These two rows enclose the lower one-third part of the body. In the third series a small but conspicuous hexagonal plate occupies the front, resting on the apex of No. 1, and having a small pentagonal plate on its right, or on the left side of the fossil. On the right side is a large rhomboidal plate, made heptagonal by being notched on its lower side to fit upon the angles of the two plates below, one of which it covers in part, the others entirely. This plate is easily recognised by the large pectinated rhomb between it and the ovarian aperture, and by the diagonally-placed rhomb, which lies partly across the fossil at the upper side of the plate in question. It is separated from the small hexagonal plate by a projection of one of the plates of the fourth series, which here rests upon a plate of the second. Two other partly rhomboidal plates of this series enclose the sides of the ovarian aperture, and meet over it.

The three last-mentioned plates of the third series are each in height about one-third of the total length of the fossil, and resting upon them are three plates of the fourth series of nearly the same size and shape, which extend to the line of the origin of the arms. The other two plates of the fourth series are more than half the whole length of the body. One of them stands upon the small hexagonal and pentagonal plates, and the other in part upon the small hexagonal plate, and in part upon a plate of the second series. All the plates of the fourth series are excavated on their summits where the five arms originate from them. They do not close the fossil at the top. The circular space surrounded by their upper extremities is closed over by a dome, in the top of which is the elongated mouth.

The five plates in the second series, and in some of the specimens the two small ones in the third, are ornamented by strong rounded ridges, which radiate from the elevated centre of the plates to the corners, or cross the sides at right angles. There are also generally one or two short ridges between the rays, while sometimes several concentric lines of growth may be observed.

The principal characters upon which the genera of Cystidea and Crinoidea have been established, are derived from the number and arrangement of the plates between the base and those points near the summit whence the arms arise. Many Crinoids, among which may be mentioned, as affording good examples, the very ancient *Heterocrinus*, several species of which abound in the same strata along with the Cystidea now under examination, and also the recent species, *Pentacrinus Caput Medusæ*, living in the Carribbean Sea, are formed simply of five vertical pillars of plates, which stand upon the pelvis, and proceed straight up the sides of the cup to the top, where each supports an arm. These, with many others that could be cited, might be properly arranged into a family, in which the distinctive feature would consist in the presence of those arm-bearing pillars of more or less quadrangular plates, placed one above the other. This structure appears, with some slight irregularities, in the unfolded calcareous shell of *Glyptocystites*, as represented in Fig. 5.

As the arms may be considered simply as continuations upwards of those pillars, and as the base of the fossil whence they arise is the back of the animal, they (the arms) are said to be developed

* The side containing the large ovarian aperture may be considered as the posterior side of the animal, and consequently the right and left sides will correspond with the right and left hands of the observer, while the anterior side will be directly opposite or in front.

from the dorsal pole of the cuticular skeleton. Volborth, an eminent palæontologist, contends that it is so in the Cystidea, and that they are true Crinoids, while several other writers upon the science maintain an opposite opinion, and regard the arms of the Cystidea as springing from the ventral aspect, and being developed downwards. Upon this curious question I do not feel myself authorized to venture an opinion, and shall content myself with directing attention to the fact that this new genus appears to be constructed very nearly upon the same plan as the Crinoids above mentioned.

The small cup of an Encrinite, figured at the end of this paper for another purpose, is formed upon a different principle. The plates of the second row alternate with those of the pelvis, and those which bear the arms do not rest immediately upon single plates below, but in the angles formed by the sloping sides of the plates of the second series. There is no trace of the arm-bearing pillars, as in *Heterocrinus* and *Pentacrinus*. It is a member of a different family, in which the genera *Cyathocrinus*, *Poteriocrinus*, *Homocrinus*, and others of similar structure may be placed.

In Fig. 6 is represented the structure of the Cystidean *Echino-encrinites*, which is the same in principle as this family of Crinoids, with alternating plates. This genus, and four others, *Pseudocrinites*, *Prunocystites*, *Apiocystites*, and *Lepadocrinites*, are all constructed exactly alike so far as regards the plates below the arms; and as they are the only Cystideans yet known to which *Glyptocystites* exhibits anything like a near approach, it must for this reason alone be considered a new genus.

The arms are five, four of them in perfect specimens extending from the summits of the plates of the fourth series to the base, and the fifth being only about three lines in length. They divide the surface into four compartments, seen in Figs. 1, 2, 3, and 4. The right side, Fig. 3, is nearly twice as wide as any one of the others. It is divided at the upper part by the short arm. The two arms on the ovarian side, Fig. 3, unite near the summit, and the grooves which occupy their centres here unite, and cross over the apex in a single furrow to the other side, where they separate, and follow down the front pair of arms. A short groove also from the apex extends to the lower end of the short arm. On each side of each groove there is a row of seven or eight protuberances, which are the bases of the tentacles.

On none of the Cystidea heretofore discovered are there more than three of those organs called *pectinated rhombs* or *ambulacral openings*, while this species displays the extraordinary number of thirteen. The office performed by them in the animal economy has not yet been explained. They consist of spaces of small extent, perforated by elongated pores, which pierce the plates to the interior. They are generally of a rhomboidal shape, and each is situated upon two plates, one half being upon each. In *Glyptocystites* they differ somewhat in external appearance from those described as belonging to the English and American Cystidea already known, but correspond in form very nearly with those of the Russian species of *Echino-encrinites*. In the Geology of Russia, as quoted by Mr. Hall in Vol. I. Palæontology of New York, p. 88, it is stated: "The *Echino-encrinites* is further distinguished by the presence of pores, not disseminated over the entire surface, as in *Echino-sphœrites*, but occupying a determinate place, and bordering three small rhomboidal areas." This is their form in *Glyptocystites*. There is in each a smooth rhomboidal space, the length of which is twice the breadth, and completely surrounding it is a row of elongated pores. The suture between the two plates, upon which each of those organs is situated, forms the greatest diagonal of the rhomb. These pores do not terminate at the border of the smooth space in the centre, but are extended beneath it, and cross over to the other side. I ascertained this fact by grinding down the surface of a specimen. When the unperforated space in the centre is thus removed, these rhombs are precisely similar to those of one of the species of *Pleurocystites*, presently to be described in this paper.

The several positions of these rhombs are as follows:

On the left side of the fossil, Fig. 1, there are two, one of which extends from the centre about half way to the summit, inclining towards the rear as it ascends, with a very small one immediately above it, and inclining to the front. It must here be noticed that, in all the large rhombs of this species, there is an elevated border along one side of the unperforated area in the centre. In this compartment the border is on that side of the large rhomb which corresponds with the left hand of the observer.

On the ovarian side, Fig. 2, two are visible, a small one under the left side of the aperture, and a large one, with the border on the left, standing perpendicularly above it.

On the right side, Fig. 3, there are five: 1st. A large one upright along the left side of the division, in length one half that of the fossil, and with the border on the right: 2nd. A small one perpendicularly above the upper end of the last: 3rd. A third lies across the fossil from the top of the large one, but inclining downwards, and with its border on the lower side: 4th. The fourth extends from the lower end of the third nearly to the summit; its border is on the right: 5th. The remaining rhomb on this side appears to be half of a large one. It consists of two rows of pores, united a little below the centre on the right side of the division, and spreading apart from each other in the direction of the point above, where the two last mentioned touch each other at their lower extremities.

On the front side of the fossil, Fig. 4, there are four of those rhombs, two of which occupy precisely the same position as two of those on the Russian species of *Echino-encrinites*. Referring again to the Geology of Russia, we find it stated: "Two of these poriferous rhombs are situated near the base, and have their greatest diagonals united upon one of the angles of the opening where the stem is inserted, while the third is found on the opposite side between the mouth and the great lateral opening, and directly above the pentagonal basal plate. The two first are mounted upon plates of the two inferior ranges, and the last upon those of the two superior ranges." In *Glyptocystites* one half of each of these two rhombs is situated on the elevated basal plate No. 1, and the other halves on the plates of the second range, which lean against its long, sloping sides. In each the border is on the upper side. By referring to Fig. 6, it will be seen that Von Buch has figured them in the same position, with the exception that there the greatest diagonal is at right angles to the suture between the plates. In this fossil, the greatest diagonal in all the rhombs follows the suture, and the lesser diagonal crosses it. In the English species of *Echino-encrinites* there is but one rhomb below and two above, while in the Russian fossils the reverse is the case. The true form and disposition of those organs, as described by Von Buch, and by the authors of the Geology of Russia, although alluded to, have evidently been overlooked in the English and American works before referred to. On the right side of the small hexagonal plate in front there is a very small rhomb, and, with its greatest diagonal running perpendicularly upwards from the centre of the upper side of this plate to the top of the plates of the fourth series, there is a very large one with the border on the left side.

The whole of the lower part of this fossil to the top of the second series is exactly like *Echino-encrinites angulosus*, as described by Von Buch, with the exception of the great height of the basal plate No. 1. He says: "The stem is very slender at its further (lower) extremity, and is provided with articulations, whose length

is three or four times greater than their diameter. Towards the cup the diameter, however, increases, the articulations approach one another and become rings, and at length, when they reach the basal plate and pass into it, this diameter is as much as one-third of the whole diameter of the cup.

"The base of the cup into which the stem passes is nearly a perfect square, which may become changed into a rhomb, the angles of which are blunted by compression of the entire form. The basal plates are deeply depressed near where the stem is attached."

This description applies so nearly, that no other is necessary for the base of the fossil now under examination. On looking at the bottom, four sharp, straight ridges will be seen, forming a perfectly square inclosure, round the opening into which the stem is inserted, and upon one of the angles of this square the lesser diagonals of the two basal rhombs are united. In *Echino-encrinites*, however, as described by Von Buch, and as is mentioned in the passage from the Geology of Russia above quoted, it is the greatest diagonal of each rhomb that points to the corner of the square.

It has been already stated that a deep groove passes over the summit, and sends down branches to the extremities of the arms. Exactly on the apex of the fossil, and in the bottom of this groove, there is an elongated oval opening to the interior, one-eighth of an inch in average length, and of the width of the groove. In this aperture all the grooves of the arms terminate as in one common centre. This is probably the mouth of the animal, and as affording an analogy in support of this view, it may be here observed that with few, if any exceptions, the grooves on the under sides of the rays of the star-fishes, the ambulacra of the sea-urchins, and the pseudambulacra of the pentremites all terminate in the mouth. In all the armless Cystideæ, the buccal orifice occupies the centre of the apex, and in the four-armed species of *Pseudocrinites*, figured in the Memoirs of the Geological Survey of England, this aperture is placed in the same position in the central point from which the arms radiate. The only other orifice on or near the top of the fossil is a minute pore upon the left side, indistinctly visible to the naked eye, which appears to be altogether too small to be considered the mouth, when we compare the great size of that organ in *Echino-encrinites*, as figured by Von Buch and Professor E. Forbes. It appears probable that, in all those Cystidea with sulcated arms radiating from the summit, the mouth will be found in the centre, where all the grooves meet.

In well-preserved specimens, the groove across the summit is filled with two rows of small oblong plates, which project upwards and lean against each other above, but do not interlock. If the apical orifice be the mouth, then, without doubt, these rows of plates formed a peculiar valvular apparatus by which it was opened and shut. They also fill the groove down to and past those points where it branches into the arms; and it is difficult to conceive what their office could be here, unless to form a covered way for certain vessels passing from the mouth to the extremities.

Figs. 7 and 8 show this part of the fossil with and without those

Fig. 7.

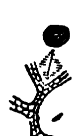


Fig. 8.

plates, and I also forward herewith two specimens which are in the same condition. There are other specimens in my possession exhibiting these and other parts in greater perfection, some of which I hope to place in the Museum of the Canadian Institute during the approaching season of navigation, when parcels of fossils can be sent with safety.

The ovarian aperture is in form like a spherical triangle, with very obtusely-rounded angles, one of which usually forms the lowest corner of this organ on the right side. It rests wholly upon that plate of the second series which stands upon the hexagonal pelvic plate, a position somewhat different from that occupied by it in the other allied genera of Cystidea. It is generally supported by this plate and the next on the left in the same series in the species heretofore made public. It is altogether in the lower half of the body, its upper margin being about half way between the summit and the base. I have found many specimens of this fossil under such circumstances as to leave but little doubt that it was unprovided with the valves by which the ovarian aperture was opened and closed in several species. In this respect it resembles also the *Echino-encrinites* of Pulcowa, so often referred to in this paper. Many of the European geologists are of the opinion that this latter had not an ovarian pyramid, while others maintain an opposite view, supposing that, in being rolled about the bottom by the waves and currents after death, the plates became detached, and thus they have never been seen; but in one locality I disinterred many specimens from a bed of shale between two strata of limestone, where it was perfectly evident that they could not have suffered any other violence than such pressure as might result from the accumulation of the deposit above them. They had evidently lived and died in this spot. The lower stratum of limestone was partly formed of their plates and disjointed columns to the depth of an inch of its upper surface, and it may be inferred from this circumstance that they had flourished here for a great length of time undisturbed. In the shale, which varied in thickness from one to three inches, were imbedded a number of perfect specimens, some of them standing nearly upright, and with the pedicle apparently still attached to the rock below. The delicate little tentacula on the arms were preserved with all the plates still occupying the grooves. It was easy to read with one glance the whole history of the catastrophe which fell upon them and occasioned their destruction. They had been buried alive by a deposit showered down upon them from a superficial current passing far above, while at the bottom it was still water. If, after death, they had not been subjected to a sufficient amount of violence to remove the tentacula, it is highly probable that, had they been provided with ovarian valves, these would also remain; but in upwards of sixty specimens discovered here and in other localities, not a trace of a valve is to be seen.

(*To be continued.*)

ERRATA.—On page 215, for "A. Elegans," read "A. elegans," and for "H. Parasitica," read "H. parasitica."

On some Points connected with the Early History of Rome.*

By the Rev. E. St. John Parry, M.A., Professor of Classics in the University of Trinity College.

"Ancient History," it has been well said, "is the biography of the dead, while Modern History is the biography of the living." "And it must therefore necessarily follow," as the same author says, "that Modern History must be especially interesting to

* The following paper originally formed the substance of a Lecture delivered before the Canadian Institute. It has subsequently undergone some alteration and modification. The Author feels bound to acknowledge the suggestions of Professor Wilson, whose view he has carefully considered, although he still inclines to Niebuhr's Theory of the Etrurian race in preference to that of Dennis.

ourselves, inasmuch as it treats only of national existence not yet extinct: it contains, so to speak, the first acts of a great drama now actually in the process of being represented, and of which the catastrophe is still future." And to carry on the idea of this great historical writer, if we may speak of the history now enacting, and in progress since the dismemberment of the Western Empire as one great Drama; we may also compare Ancient History to the Prologue of that Drama, or rather, perhaps, to the mass of presupposed action and interest, of which the Drama itself takes no account but in so far as its own colour and incidents are derived from it. It is in this point of view that Ancient History interests us so deeply, as containing not only the type of what follows, but in many cases the actual germ from which our own institutions, our own political forms, are primarily derived. This is true of the Early History of Rome to a greater extent perhaps than of any other History. From the Roman Empire we have derived many of our distinguishing national institutions, as well as a large element of our language. In its early History we find these institutions embedded, as it were, amid a mass of heterogeneous matter: from which it requires much labour and discrimination to detach them. Some of the greatest geniuses of Modern times have been employed in investigating this subject. Glareanus, Perizonius, Beaufort, and Vico, are some of the names which every Scholar reveres for their services done to the cause of critical historical enquiry; and if we give Niebuhr the precedence above them all, it is because he has brought to bear upon a subject which they had previously touched upon, the full strength of modern criticism, aided by a commanding and practical genius; carrying with him to the investigation of early Roman History the experience of the diplomatist and financier, and above all, the unbending patience of the Teutonic character, he has reproduced so faithfully before the present generation the genuine form and features of the old Republic, that we are tempted to pay him an almost undivided homage, and to recognize in him the Second Founder of early Rome.

Within the limits of this paper, it is impossible to give a general account either of modern discoveries, or of the early history which they illustrate. It will be sufficient to endeavour to illustrate one or two subjects: and we may confine our aims to some few notes on the Ethnology and Languages of Ancient Italy.

I. ETHNOLOGY.

1. *Pelasgians.* The greater part of Italy appears in very early times, to have been inhabited by the Pelasgians, whether under the name of *Siculians, Aborigines, Œnotrians, or Tyrrhenians.* Under one or other of these names, they occupied the southern part at least of Etruria; the district round Reate in the Sabine territory, and the west and east of Southern Italy. It is generally allowed that these Pelasgi, were part of that extensive and wide spread family, which many centuries before our era occupied all the countries situated on the Mediterranean, from Etruria to the Bosporus. We find their monuments—commonly known as the Cyclopean masonry, in Arcadia, Argolis, and Attica, in Greece; in Etruria, and Latium, in Italy.* These walls formed of enormous blocks, raised as it were by the hands of Giants, have defied the lapse of time, and still remain to us as unaccountable monuments, whether of the skill or of the strength of the extinct race. The general family of the Pelasgi is found at Dodona, worshipping the mystic voice of the prophetic dove; at Lemnos, Imbros and Samothrace, successors of the Cabiri, deriving their rites from the religion of the East. Theirs was Troy,† the great Pelasgic town, whose founder, Dardanus, was fabled in various legends to have come from Arcadia, from Samothrace, or from Cortona; all historical centres of the early Pelasgic race.

The Pelasgians are generally reported by writers of antiquity to have formed settlements on the coasts of Italy; and in the various legends of the foundation of Italian towns by the race, we perceive that they are traced to two centres, the Arcadian and Argive Pelasgi, and the Lydian or Tyrrhenian Pelasgi. It cannot be doubted that the Pelasgians, as an unsettled and seafaring race, may have occupied simultaneously many points on the coast of Italy. As a commercial and industrial race, they would naturally establish themselves on the sea coast, and at the mouths or on the banks of the larger rivers. Thus we find them, according to tradition, occupying twelve cities on the banks of the Po, twelve in Etruria, and twelve to the south of the Tiber; corresponding to the same Pelasgic number of twelve townships in Attica, twelve towns forming the Amphictyonic League in Greece, the Æolian and Ionian Leagues in Asia Minor. If we remember what has just been noticed, viz:—the dispersion and industrial character of the Pelasgic nation, we are at no loss to account for their disappearance from history: they are indeed branded in Grecian story as blood-thirsty marauders; of their race is told the tragedy of Lemnos, the inhuman murder of Phocœan prisoners at Agylla. Nor can we doubt that these tales arose from the hatred of the warlike Greeks to an agricultural and industrial population, distinct from the heroic tribes who afterwards peopled both Greece and Italy, in their possession of a knowledge of nature which inspired their enemies with fear and with hatred. The Telchines of Rhodes, the wizards of ancient fable; the Cyclopes of Peloponnesus and Sicily, who penetrated the depths of the earth with lamps fixed on their foreheads, the one-eyed miners of antiquity; the Cabiri of Lemnos and the Eastern Pelasgic races—workmen as well as Gods, who were worshipped under the image of earthern jars, the emblems of the mystery of the potter's art: all these teach us that the genius of the Pelasgic race was one of industry and skill, both undervalued by their ruder contemporaries. So the Pelasgi in Italy were made subject to various conquerors; those of the North to the Gothic Rasena; those of Centre Italy (the Siculians inhabiting Latium) to the Oscans, who drove them into the island which has ever since retained their name; those of the South (the Œnotrians and Peucetians) when the invading Hellenes subjugated their old seats in Lucania and Apulia, were reduced to serfdom, as their kinsmen were in Etruria; while a portion of them, the Bruttii, retained for ever the name as well as the condition of slaves.

The consideration of the history of this Pelasgic race, and its settlement in Italy, is so intimately connected with the after condition of their chief territory (that of Etruria), that we may here anticipate a little the course of events, and advert to the conquest of Etruria by the Etruscans.

* The force of this argument for the identity of the Italian and Greek Pelasgi has been questioned; but although some such works may be found of a much later date, yet we must accept the existence of such monuments as are unquestionably of ancient date, appearing contemporaneously in Greece and Italy, as a strong evidence of some connection between the tribes that at that period occupied those two countries.

† Professor Newman, while rejecting much of Niebuhr's speculations concerning the Pelasgi, thinks that "we may well accept his conjecture that the migrations of the Pelasgians by sea from the coast of Troas to Sicily and Italy, carrying with them their Penates and religious worship, generated the poetical legends concerning Æneas and others; indeed it can hardly be doubted, that the worship of the Penates, and Palladium of Lavinium, which Æneas was supposed to have conveyed thither, was strikingly similar to ceremonies practiced on the north and north-east coast of Ægean." (Newman's Regal Rome, p. 8.)

The early inhabitants of Etruria were Tyrrhenians, a branch of the Pelasgic race. That they were at any rate closely connected with the early inhabitants of Greece, if not belonging to the same great family, is clear from several considerations. These Tyrrhenians appear by the preponderating evidence of antiquity to have migrated from Greece and Asia Minor. Succeeding and conquering them we find a race which is referred to Lydia as its mother country on the testimony of Herodotus, as well as of many other ancient authors. This theory of their origin has been supported by Mr. Dennis, and quite lately by Professor Newman. On the contrary we have the absence of any corroborating testimony in Xanthus, the annalist of Lydia, as noticed by Dionysius; and the fact that the language, religion, and institutions of these Etruscans did not correspond with those of Lydia. This negative objection is overruled by Newman on these grounds:

1. That the positive testimony of Herodotus is worth far more than the omission of Xanthus.

2. That the tendency of fiction in nations is to remodel the past, not the future. "They feign forefathers," he says, "not children: so that this belief of the Lydians is a weighty circumstance."

3. That the native population of Etrusia was then *Umbro-Pelasgian;* and that the language and institutions of the Etrurians would naturally undergo a sensible change from their proximity to the old population, just as the language of the Lydians themselves had undergone a sensible change during the vicissitudes which befel them in the growth of the Persian Empire.

Niebuhr, as is well known, combats this view; and would derive the Etruscans from the country north of Italy, supposing them to have conquered the Tyrrhenians and Umbrians, and occupied Etruria proper and the country about the Po. This view is that which, after all that Professor Newman urges against it, seems nevertheless to rest on the surest ground. I will, before proceeding to state the accepted theory of the Etruscan History and their invasion of Central Italy, offer one or two remarks on the arguments by which Mr. Newman has endeavoured to set aside that theory.

1st. As to the positive testimony of Herodotus. His account of the story may be freely translated as follows :—

"The Lydians say of themselves, that the common games which are now in use in Greece are their invention; and that, besides inventing these games, they moreover sent a colony to Tyrsenia. The following is their story:—In the days of Atys, the son of Manes, their king, there was a sore famine throughout all Lydia. And for a time the Lydians lived in distress, but afterwards, when the famine stayed not, they sought for remedies against it. It was then they say that they invented dice, and knuckle-bones, and ball, and all other kinds of games except draughts. * * * * For one whole day then they played games that they might not want food: and the next day they took their turn to eat, and rested from their games. Thus they lived for eighteen years. But when the evil abated not, but rather grew worse and pressed them sore, then at last their king divided all the Lydians into two parts, and drew lots for the one to remain at home, and the other to leave the country. And with the lot that drew to remain at home the king joined himself; but with that which was to depart from the country, he joined his own son, whose name was Tyrsenus. Now the party who were appointed by lot to depart out of the land went down to Smyrna, and built ships for themselves, and put in them all their moveable property, and sailed away to look for a livelihood and a home: and they passed by many nations, until they came to the Ombrici. And there they built cities in the land, where they live even unto this day. But they changed their name from Lydians after the name of their king's son, who had led them out, and were called Tyrsenians." (Hdt. I. 94).

I think that no one who reads this paragraph can fail to observe that Herodotus tells this tale merely as a tale, and does not attach to it any great importance. We have no words of criticism, or of assent, such as he so often appends to stories in themselves far more probable. He seems to class it with the invention of games, and to give the Lydians credit for one as lightly as for the others. At any rate, the amount of credit which Herodotus gives to this story can hardly be characterized as positive testimony, or be set against the omission of any such account in Xanthus, who, more perhaps than any one, would have endeavoured to raise the historical importance of his country by recording this legend, if he had regarded it as entitled to credit. I confess that it seems to me to belong too clearly to the *a posteriori* class of fictions, where the name of the hero is represented as descending to the people and the country, where the national life is traced fondly back to some semi-heroic *eponymus*—to some god, or child of a god, who had left Olympus and walked among men, and founded for himself a city and a people in the golden age. This tendency is illustrated by many familiar instances, which we need not recall to our readers' minds; but it may be interesting to observe how such a fiction may arise, not only in an early and credulous age, but at a cultivated and critical period—nay, how even the critic may show undue credulity, misled by this name-parentage of early fiction. Let us take as our instance Tacitus, the historian, the sceptic; a man of all others the most likely, we should think, to have entertained that "*wise disbelief*" which "is our first grand requisite in dealing with materials of mixed worth." And yet, when treating of the history and institutions of the Jews, he shows not only ignorance and prejudice, both of which we can easily account for, but he gives us a remarkable instance of the tendency of eponymising (if we may coin an expressive word) which we have noticed above. Among various theories which he mentions, these two are to the point: "Quidam (memorant) regnante Iside, exundantem per Ægyptum multitudinem, ducibus *Hierosolymo* ac *Juda*, proximas in terras exoneratam;" and again: "Alii, Judæorum initia, *Solymos*, carminibus Homeri celebratam gentem, conditam urbem *Hierosolyma* nomine suo fecisse."—(*Tac. Hist.*, V. 2, cf. also, 3–8.)

2. Professor Newman's second argument does not appear conclusive. Although the fabulous tendency in nations looks to the future rather than to the past; although "they feign forefathers," as he says, "not children," yet we cannot allow that this belief of the Lydians is in itself a circumstance of any great weight; for we must distinguish between the art of inventing a posterity gratuitously, so to speak, and the art of claiming the parentage of a nation already existing, and presenting sufficient marks of a family likeness to render the claim feasible. This we conceive to have been the case with the Lydians. They found a nation existing in Italy in whom they recognized some marks of a common stock. This nation they claimed as their offspring. Their claim must be modified or rejected according to one of two alternatives. We may suppose that the nation whom they wished to claim was merely one branch of that Pelasgic family which has its seats in Lydia as well as in Italy. In that case, they may have had a real connection with that western outpost of their family, but with the Tyrrheno-Pelasgic inhabitants of Etruria, not the Etrurians proper. Or, secondly, if we consider this legend as referring to the strict Etrurian race, we feel bound to

reject it—to class it among other national claims to an illustrious progeny, placing it in the same category with the claim of the Jews to the colonization of America,* or with the rival claim of the ancient Welch to a discoverer and colonizer of the New World in the person of their fabulous Prince Madoc.

3. The change of language is equally explicable on either theory. Whatever were the respective languages of the original inhabitants of the country and of its later conquerors, it is very probable that both underwent considerable modification, so that we can easily account for the appearance of a new composite tongue, equally distinct from Pelasgian and from pure Etrurian. Thus much we may say here, in anticipation of what will fall into its place more properly when we come to consider the Languages of Ancient Italy.

These considerations appear to my mind feasible enough to incline us to agree with Niebuhr rather than with Dennis, to look for the Etruscans rather to the north of the Italian Peninsula than to the east. So far we agree with Dennis that in Etruria are found many traces of the influence of Eastern customs and religion; but we hesitate to make the introduction of these customs contemporary with the incursion of the Rasena or pure Etruscans. The monuments discovered in Etruria only increase our difficulty. Not only do they present us with an unintelligible language, but they further perplex us by the strange medley of religions which appears in them. As Michelet describes them:—"These men, with large arms and large heads, remind one of the statues found in the Mexican ruins of Palanque. * * * * * * This eagle-horse carries me to Persia; these personages who cover their mouths as they address a superior seem to have been detached from the bas-reliefs at Persepolis. At their side I see the man-wolf of Egypt, the Scandinavian dwarfs, and perhaps the mallet of Thor." Without following out all the fanciful resemblances perceived by this author, we yet clearly perceive enough uncertainty to forbid our basing upon these remains any very important theory.

How, then, are we to explain the history of Etruria?

I. We must remember that there was existing in the country from the earliest times of which any record remains, a population which may be described as Tyrrheno-Pelasgian, composed of a mixture of the distinguishing Italian with the Greek element. This race perhaps supplanted an old Umbrian population, probably existed side by side with it. At all events, it is found in Etruria in the middle of the sixth century B.C., at which time Agylla is mentioned by Herodotus as a town consulting the oracle at Delphi, in which temple it had a chapel or storeroom—an evidence of Pelasgian origin.

II. Against this nation (a peaceful industrial population, as we have noticed above) there came from their fastnesses in the Rhætian Alps the warlike *Rasena*, known to the Romans by the name of Etrusci. Livy (v. 35.) considers the Etruscans to have been Rhætians; although, as he observes, their language had been greatly modified by the circumstances of their local position. However this may be, yet we have every reason to conceive that the race which now infested Italy was neither Umbrian, nor Lydian or Pelasgic, but Gothic; that they swept from the Alps, like their successors the Gauls, in an overwhelming torrent, conquered Lombardy, and thence, passing down the western side of the Appeninnes and forcing, perhaps the Umbrians who still inhabited Northern Etruria, to cross the mountains and confine themselves to the Eastern coast, they spread down from Lake Trasimenus along the valley of the Tiber, and flooding the country to the sea coast, established within those limits the empire of the Rasena.

This period may be marked by the date 523 B. C., at the latest: for we know that between that date and 533 B. C., Agylla (afterwards Cære) was still a Pelasgo-Tyrrhenian town in communication with Delphi. From that date to about 470 B. C. is the probable period of Etruscan conquest: and during this half century they must have overrun Central Italy and received the submission of Latium, and, among the Latin towns, of Rome herself.* In the year 470 they are said to have founded Capua; and were about that time at the height of their power. Hiero broke their naval power at the battle of Cuma, and about the same time, in all probability, a rising of Latium took place, when they were beaten back with loss from under the walls of Aricia. From that period their power declined. The Romans, after shaking off their temporary yoke, rose steadily. The Etruscans were henceforth confined within the Tiber as their southern border. About the middle of the 4th century of Rome the Gauls deprived them of their possessions in Lombardy. In B. C. 280, they are admitted to terms of lasting friendship with Rome; and continue the faithful allies of Rome for two centuries till in the year 88, they, together with the Umbrians, received the Roman franchise.

More has been said of this branch of Italian ethnology than would have been necessary, and more perhaps than may seem compatible with the restricted limits of this paper, because I found it necessary to disagree with the views put forth by Professor Newman, and was unwilling to do so without assigning my reasons more at length. We may pass on more briefly to a notice of the remaining nations who may be classed among the early inhabitants of Italy.

The *Umbrians and Oscans* seem to have occupied large portions of Italy to the north and south of Latium. Under this class of nations were included the hardiest and most warlike of Italian nations. The hardy Samnites, who maintained many bloody wars against the power of Rome and Latium; the Volscians, those eternal enemies of the Roman name; the Sabellians, the mountain shepherds, distinguished from the less hardy Osci, who cultivated the plains. The former worshipping Mavus, Mamers, or Mars, adored under the form of a lance; the same deity, whose name was derived from the Sabine *quiris*, a spear, and worshipped as Quiruius in early Rome. The latter worshipping a kind of Hercules, known by the names Sabus, Semo, Sancus, Fidius, the same deity whose name, we know, inscribed "Semoni Sanco" on a stone found on the island in the

* The question of the probable locality of the Jews of the Dispersion has excited much curiosity since the time that Alexander the Great, followed by birds who spoke Greek, attempted to find the Rechabites in the dark mountains. Penn, we know, fancied he had discovered the Jews in America, and supposed them to have passed over from the eastern extremity of Asia to the western extremity of America. Others have discovered them beyond the Corderillas, have even traced the route by which the tribe of Reuben reached the West Indies, or have bridged over Behring's Straits to make the migration more probable. Nay, we are told that Noah spent the last 350 years of his life in colonizing various parts of the earth. Others have traced the Americans from the Canaanites who fled before Joshua, from the Carthaginians, or from the nations who would not embrace Christianity. The migration of Madoc is placed A.D. 1170, and has been made the theme of poets and historians. We may spare ourselves the trouble of refuting these opinions, for they refute each other. They are brought forward here as an instance of the contradiction and difficulty which attends these national traditions, and of the large share which national pride or religious bias may have in their construction.

* This fact, though disguised by Livy, as he followed the old poetical story, is expressly admitted by Tacitus, (Hist. III. 72.) and proved at large by Niebuhr. (Hist., Vol. I., p. 541-551, &c., Eng. Tr.)

Tiber, gave rise to the tradition mentioned by Justin Martyr, (Apol. I., 26) that Simon Magus was worshipped as a god at Rome, and that a statue in his honor had been erected by Claudius Cæsar.

This family of nations inhabited the districts known by the names of Umbria, Picenum, Sabinum, Samnium, and Lucania.

The chief element of Italian population which we have hitherto left unnoticed is the Greek, purely derived from Latin Greece, and distinguished from the Pelasgic population which had settled in Italy long previously. The earliest Greek colony in Italy was Cumæ, in Campagnia, which is referred to a fabulous date. There were, no doubt, many other towns of which there is no distinct record. Even in Southern Etruria we can trace in the legend of Tarquinius, and the story of the arrival of Demaratus from Corinth with the artists Euchir and Eugrammus, a link between the sea-board of Etruria and the maritime cities of Peloponnesus. In Magna Græcia the Greek element was most firmly planted, and there, both in religion and in philosophy, it gave rise to a school as distinguished as any in old Greece itself.

(*To be continued.*)

List of Indigenous Plants found in the neighbourhood of Hamilton, with the dates of their being found in Flower and Examined.

By Dr. Craigie and Mr. W. Craigie.

April 21*st*.
Symplocarpus fætidus.
28*th*.
Sanguinaira Canadensis.
Hepatica triloba.
Claytonia Virginica.
Erythronium Americanum.
May 4*th*.
Viola ovata.
" pubescens.
Leontice thalictroides.
Trillium erectum.
8*th*.
Thalictrum anemonoides.
Viola cucullata.
" blanda.
" Canadensis.
Dicentra Canadensis.
" Cucullaria.
Chrysosplenium Americanum.
Uvularia perfoliata.
Trillium grandiflorum.
" cernuum.
10*th*.
Caltha palustris.
Dentaria diphylla.
Panax trifolium.
Anemone nemorosa.
Fragaria Virginiana.
11*th*.
Cardamine rhomboidea.
Dentaria laciniata.
Ranunculus abortivus.

May 12*th*.
Asarum Canadense.
Waldsteinia fragarioides.
Amelanchier Canadensis.
14*th*.
Mitella diphylla.
Saxifraga Virginiensis.
Phlox divaricata.
Ranunculus sceleratus.
16*th*.
Xanthoxylum Americanum.
Lonicera ciliata.
Atragene Americana.
21*st*.
Thalictrum dioicum.
Viola sagittaria.
Tiarella cordifolia.
Arum triphyllum.
22*nd*.
Zizia aurea.
Sassafras officinale.
Sambucus pubens.
Benzoin odoriferum.
23*rd*.
Platanthera bracteata.
Actæa rubra.
" Americana.
Cornus Canadensis.
Lithospermum arvense.
24*th*.
Trientalis Americana.
Ribes hirtellum.
27*th*.
Smilacina stellata.

May 27*th*.
Osmorhiza brevistylis.
Geranium maculatum.
Cerasus Pennsylvanica.
Zizia integerrima.
28*th*.
Streptopus roseus.
Orchis spectabilis.
Prunus Americana.
Ribes floridum.
Pedicularis Canadensis.
Castilleja coccinea.
Cardamine hirsuta.
29*th*.
Polygonatum pubescens.
Podophyllum peltatum.
Rubus triflorus.
30*th*.
Prosartes lanuginosa.
Staphylea trifolia.
Veronica peregrina.

June 4*th*.
Cornus Florida.
Cratægus coccinea.
Cerasus Virginiana.
Geranium Robertianum.
Cerastium hirsutum.
Cypripedium pubescens.
Acer spicatum.
Veronica Americana.
5*th*.
Potentilla Canadensis.
Cratægus punctata.
Aquilegia Canadensis.
Hydrophyllum Virginicum.
Sanicula Marilandica.
Platanthera Hookeri.
7*th*.
Lathyrus ochroleucus.
Comandra umbellata.
Smilacina bifolia.
Erigeron bellidifolium.
9*th*.
Triosteum perfoliatum.
Aralia nudicaulis.
Cornus circinata.
Smilacina racemosa.
10*th*.
Cerasus serotina.
Cornus alternifolia.
12*th*.
Cornus stolonifera.
Viburnum Lentago.
Rubus villosus.
Pyrola rotundifolia.
16*th*.
Linnæa borealis.
Calla palustris.
Celastrus scandens.
18*th*.
Leucanthemum vulgare.
Euonymus Americanus.
19*th*.
Aphyllon uniflorum.

June 21*st*.
Stellaria longifolia.
Circæa alpina.
Specularia perfoliata.
Potentilla Norvegica.
Osmunda cinnamomea.
" interrupta.
23*rd*.
Viburnum acerifolium.
Diervilla trifida.
Veronica officinalis.
Myosotis laxa.
24*th*.
Lilium Philadelphicum.
Pentstemon pubescens.
Campanula rotundifolia.
Polygala Senega.
Hypericum perforatum.
Rosa lucida.
Liriodendron tulipifera.
Gillenia trifoliata.
Ranunculus fascicularis.
25*th*.
Sagittaria variabilis.
Pyrola elliptica.
Cynoglossum officinale.
Euphorbia platyphylla.
Frasera Caroliniensis.
Oxalis stricta.
Lysimachia quadrifolia.
30*th*.
Iris versicolor.
Utricularia vulgaris.
Nuphar advena.
Nymphœa odorata.
Asclepias incarnata.
" debilis.
Apocynum cannabinum.
Lathyrus maritimus.
Geum Virginianum.
Archangelica atropurpurea.
31*st*.
Prunella vulgaris.
Sisyrinchium anceps.
Galium triflorum.
" lanceolatum.
Botrychium Virginicum.
Hypoxis erecta.
Medeola Virginica.
Mitchella repens.
Silene noctiflora.
July 2*nd*.
Asclepias phytolaccoides.
" Syriaca.
Cornus paniculata.
Moneses uniflora.
3*rd*.
Hydrophyllum Canadense.
Rhus typhina.
Sparganium ramosum.
Allium tricoccum.
Lathyrus palustris.
Vicia Americana.
Lathyrus myrtifolia.
Stachys aspera.

JULY 4th.
Trifolium procumbens.
" arvense.
Galium boreale.
Malva rotundifolia.
Euphorbia polygonifolia.
Verbascum Blattaria.
Lepidium Virginicum.
Polygonum convolvulus.
11th.
Epilobium augustifolium.
" coloratum.
Thalictrum Cornuti.
Ranunculus acris.
Rubus odoratus.
Pyrola secunda.
" asarifolia.
Sambucus Canadensis.
Anemone Virginica.
12th.
Ceanothus Americana.
Apocynum androsæmifolium.
Geum strictum.
Anemone Pennsylvanica.
Rudbeckia hirta.
14th.
Lilium superbum.
Lysimachia ciliata.
15th.
Hydrocotyle Americana.
Orchis hyperborea.
16th.
Solanum dulcamara.
Ranunculus aquatilis.
Circæa Lutetiana.
Galium asprellum.
Helianthus trachelifolius.
Cnicus arvensis.
Agrimonia Eupatoria.
Aspidium acrostichoides.
Monarda fistulosa.
Lysimachia stricta.
Tilia Americana.
Physalis viscosa.
Sium lineare.
Eupatorium perfoliatum.
18th.
Scutellaria galericulata.
Œnothera biennis.
Antennaria margaritacea.
19th.
Corallorhiza multiflora.
Chimaphila umbellata.
Ampelopsis quinquefolia.
Hypericum corymbosum.
Campanula Americana.
Monarda didyma.
20th.
Gerardia flava.
Lobelia puberula.
Halenia deflexa.
21st.
Melissa clinopodium.
Teucrium Canadense.
Gaultheria procumbens.

JULY 22nd.
Polygonum Persicaria.
Mimulus ringens.
Erigeron Canadense.
Barbarea vulgaris.
Arctium lappa.
24th.
Lobelia spicata.
Phryma leptostachya.
Cicuta maculata.
Desmodium acuminatum.
Euphorbia corollata.
Asclepias tuberosa.
Astragalus Canadensis.
Melampyrum Americanum.
26th.
Polanisia graveolens.
Solidago Canadensis.
" odora.
Datura stramonium.
Potentilla Anserina.
Cicuta bulbifera.
Bidens connata.
Phytolacca decandra.
Clematis Virginiana.
Verbena hastata.
Calystegia sepium.
Eupatorium ageratoides.
Impatiens fulva.
" pallida.
Mentha Canadensis.
Saponaria officinalis.
Eupatorium purpureum.
Polymnia Canadensis.
Urtica divaricata.
Aspidium marginale.
Polypodium vulgare.
Polygonum aviculare.
30th.
Scrophularia Marilandica.
Aralia racemosa.
Leonurus cardiaca.
Cnicus lanceolatus.
31st.
Aster miser.
" corymbosus.
Inula Helenium.
Desmodium Canadense.
" cuspidatum.
Cynoglossum Morisoni.
Platanthera psycodes.
Struthiopteris Pennsylvanica.
Spiræa salicifolia.
Penthorum sedoides.
Chimaphila maculata.
Goodyera pubescens.
Lobelia inflata.
Desmodium nudiflorum.
Veronica anagallis.
Hypopitys lanuginosa.
Sonchus oleraceus.
Heracleum lanatum.
AUGUST 4th.
Gerardia quercifolia.
" pedicularia.

AUGUST 4th.
Solanum nigrum.
Decodon verticillatum.
Aster Tradescanti.
Desmodium paniculatum.
Lespedeza frutescens.
Desmodium Dillenii.
Circium discolor.
Polygonum Pennsylvanicum
" amphibium aquaticum.
Aster macrophyllus.
" simplex.
Dryopteris thelypteris.
Camptosorus rhizophyllus.
Lactuca elongata.
Solidago altissima.
5th.
Chenopodium urbicum.
Hieracium longipilum.
" Canadense.
Nabalus albus.
Baptisia tinctoria.
Lobelia syphilitica.
Epilobium palustre.
Acalypha Virginica.
9th.
Scutellaria lateriflora.
Collinsonia Canadensis.
15th.
Rumex hydrolapathum.
" Cuscuta Americana.
Pontederia cordata.
Diplopappus albus.
Helianthus strumosus.
" giganteus.
Phaca neglecta.
Liatris cylindracea.
17th.
Polygala fastigiata.
Tofieldia pubens.
Lobelia cardinalis.
18th.
Bidens frondosa.
Solidago squarrosa.
" bicolor.
" latifolia.
Polygonum hydropiper.
Erigeron strigosum.
Lespedeza hirta.
Pycnanthemum incanum.

AUGUST 18th.
Hedeoma pulegioides.
20th.
Apios tuberosa.
Polygonum amphibium terrestre.
Gerardia tenuifolia.
Hieracium paniculatum.
Phaseolus helvolus.
Scutellaria parvula.
Artemisia Canadensis.
" gnaphalodes.
Bidens chrysanthemoides.
" cernua.
Polygonum Orientale.
28th.
Parnassia Caroliniana.
Spiranthes cernua.
Gentiana Andrewsii.
Abutilon avicennæ.
Chelone glabra.
Senecio vulgaris.
Cirsium muticum.
Solidago cœsia.
" puberula.
" patula.
" Muhlenbergii.
" altissima.
Aster multiflorus.
" longifolius.
" puniceus.
" novæ Angliæ.
" acuminatus.
SEPTEMBER 1st.
Amphicarpœa monoica.
13th.
Polygonum arifolium.
" sagittatum.
" lapathifolium.
Solidago nemoralis.
" latifolia.
Lechea minor.
Aster amplexicaulis.
" dumosus.
" prenanthoides.
" azureus.
" cordifolius.
" patens.
25th.
Gentiana quinqueflora.
" crinita.

Toronto Harbour—Its Formation and Preservation.

Read before the Canadian Institute, by Sandford Fleming, C. E., June 1, 1850.

(*Continued from page* 107.)

Second, That the Peninsula proper has been formed solely by the mechanical action of the waves, that the sand and gravel of which it is composed have been by this action gradually transported from the eastward and deposited on the deltaic shoal of

the Don, and that the delta has thus been raised above the surface of the water and extended westward far beyond its original limits.

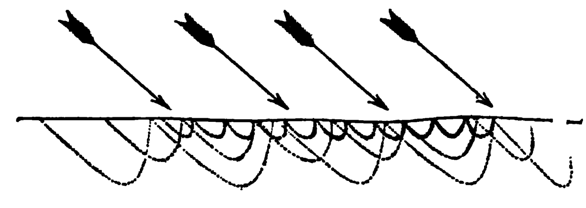
The effects produced by waves on a shore exposed to their action are of various kinds, depending in a great measure on the nature of the beach, the direction of the waves, and their mechanical force: if the shore be of clay the action is entirely destructive, the banks are undermined and continually caving in, the fine argillaceous particles are taken up by the water, carried out and deposited after a time at depths unaffected by the motion at the surface; if the shore be of sand or gravel the effects produced are quite different. When the direction of the waves is not at right angles to the beach a progressive action results, and when the waves break point blank on the shore line with sufficient force the action is destructive, in which case the banks are broken down and the spent wave returns loaded with sand to be deposited outside of the breakers in the form of a shoal generally parallel to the coast; if the soil of which the banks are composed be a mixture of clay and sand the action is both destructive and progressive, the clayey particles are washed out and deposited in still water, while the sand, gravel, and stones are left behind to be moved forward either in one direction or another, and at a rate depending solely on the strength of the impinging waves, and the gravity of the materials themselves. On a rocky shore the effects produced are precisely similar, although of course to a much more limited extent; by continual exposure to the wearing action of water and weather a mass is undermined and tumbles down, a portion of the debris is put in progressive motion during every storm when the waves impinge otherwise than at right angles to the shore line, and is moved, according to the locality, in a certain prevailing direction, until meeting a projecting point or other hindrance to its onward progress; thus forming those shingle beaches seen at many places on all rocky shores.

The effects of the destructive action on banks of clay can be traced wherever the shore is entirely of that material; the owners of property along many parts of Lake Ontario can bear testimony to its annual encroachments; and, to come nearer home, many citizens of Toronto must have witnessed the gradual alteration in the form and recession of the clay banks between the old and new garrisons.

The effects of the progressive action can also be witnessed at many points on all the lakes; but at none in a more remarkable degree than at Toronto, although at other places to even a much greater extent. And since to the peculiar motion of sand and gravel beaches will be attributed not only the extraordinary changes the Peninsula is at present undergoing, but even the greater part of the entire formation, it will be necessary to explain fully the nature of it, and give the reasons why the beach should have a tendency to move in one direction in preference to another.

Let us take an example when the direction of the wind forms an acute angle with the shore, a particle of sand resting on the surface is driven forward up the inclined plane of the beach in the direction in which the wave itself moves, the particle either remains at its now elevated position or (as is more usual) sweeps along in a small curve and rolls downwards with the expended wave to a new position, the distance of which from the first will be in proportion to the mechanical force of the wave and its direction; another and each successive wave drives the particle forward in a similar manner, unless by accident it finds a resting place behind some obstruction or be buried by other particles on the same mission as itself. If we take instead of a grain of sand, a small pebble, we find that the same wave, or a wave having the same force, moves it a less distance than it does the sand, that larger pebbles being heavier make proportionately less progress, and that stones still heavier are moved only when the waves have considerable power. All of these bodies, however, when within the impelling force of the wave and placed in positions fairly exposed to its direct action, seem to be governed by the same law, and are moved forward a less or greater distance according to their weight and gravity.

Fig. 2.

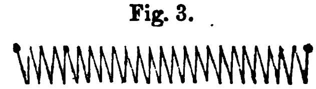


The arrows denote the direction of the waves; the dotted lines show the paths of grains of sand and pebbles.

The zig-zag direction taken by the sand and gravel on the beach is indicated by the various dotted lines on Fig 2, the smallest one is intended to show the course of a grain of sand, and the two largest lines that of pebbles varying in size. The progressive motion is slightly suspended between each wave, but although intermittent is continued so long as the sea breaks on the shore from the same quarter, and until the moving mass meets with an obstruction, or by reason of a sudden bend or other peculiarity of the shore line is deposited in a position beyond the influence of the waves.

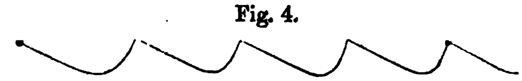
When the waves impinge at right angles to the shore the progressive motion of the beach is theoretically nothing, the various particles of sand are rolled upwards and downwards, changing position only laterally or in the line of direction of the waves; when the waves impinge somewhat less than a right angle the grains of sand move along in a sharp zig-zag line, as

Fig. 3.



in Fig. 3, when much less than a right angle the particles move onward in a long undulatory line as in Fig. 4. The distance between the points of each indentation being in proportion to the cosine of the angle formed by the direction of the waves and the line of the shore.

Fig. 4.

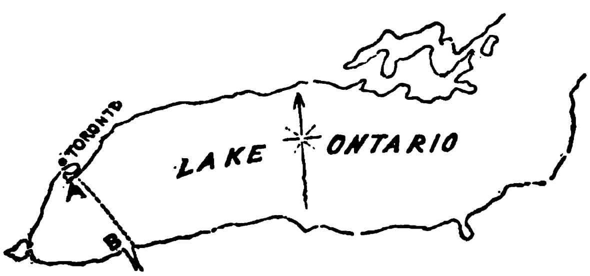


Granting that the direction of the waves is governed by that of the wind, it follows that whenever the wind blows from a quarter to the right of a perpendicular to the shore, the beach sand is moved to the left, and *vice versa*. If, therefore, the wind blew with equal strength and during equal times from all points of the compass throughout the year, and the waves also had at all times the same mechanical force, the sand would at one time move to the right, and at another time an equal distance to the left; but, to speak in general terms, the beach would remain ever as it was (excepting the effects of the destructive action). Since the forces never could act simultaneously, we would have, it is true, a constant repetition of complicated motions, zig-zag, un-

dulatory, lateral, progressive, and retrograde; but, from their assumed equality and the equal times of their application, there could be no resultant. The mean velocity of the wind may properly enough be taken as equal throughout the year from all points of the compass, since the actual difference, as obtained by observations, will effect the results inappreciably; but the mean force of the waves will not in consequence be equal, as this is greatly influenced by the locality. It is found that the mechanical force of a wave depends chiefly on the strength of the wind and the extent of open water traversed; allowing then that the wind blows equally from all points, it will follow that the resultant of the aggregate forces of the waves impinging at any particular place, will be a line lying in a direction opposite to the largest area of open water.

In applying this conclusion to the beach in front of Toronto we find that the greatest extent of Lake Ontario passed over by winds blowing from any point westward of the perpendicular A B, Fig. 5, does not exceed forty miles, nor is the area of water over twelve hundred square miles, while to the East of A the

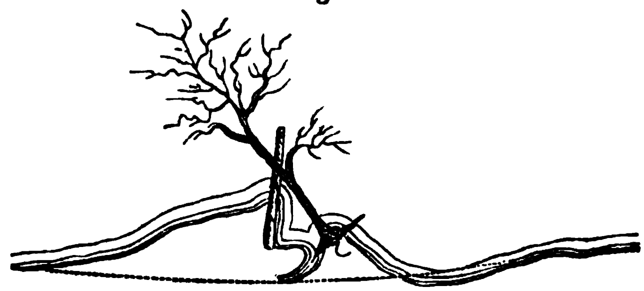
Fig. 5.



waves have a fetch of as much as a hundred and eighty miles over an expanse of water measuring nearly nine thousand square miles; hence then (the duration of the action being taken as equal in both cases) the intensity of the collective forces of waves impinging at A from the eastward is many times greater than that of those from the westward, and the motion of the beach at A must therefore be westerly; it must of course move with a variable velocity because the forces are not constant; its path, or rather the path of each particle, undulatory, since the forces act impulsively on the plane of the beach in combination with gravitation; it must sometimes retrograde since the direction of the forces is ever changing, and they never act simultaneously; but aggregately, the beach sand, subject to many complicated motions, and acted on by innumerable and incalculable forces, must move absolutely from east to west, and (taking the forces on each side of line A B respectively as positive and negative) with a velocity proportionate to their algebraic sum.

On that portion of the beach successively washed by the waves only, can the progressive motion be proved occularly, yet doubtless a similar action must be produced between the breakers and the main land all along the shore, and when we consider that the lake is seldom or never entirely at rest, that even during perfect calms, unless continued for several days, a gentle ripple capable of moving sand is found on the shore, throughout the whole year, therefore, must the materials composing the beach be continually changing place, and although sometimes moving easterly, yet generally, as proved above, in the contrary direction.

Fig. 6.



The accompanying drawings of natural groynes very strongly confirm the conclusion here come to. They are copied from sketches recently taken (1850) on the spot, between Privat's Hotel and the Scarboro' Heights. Fig. 6 was formed by the falling of a tree opposite a fisherman's hut east of the Narrows on a passing log: the outer end of the tree was supported by its branches: about one half of the log was floating, but kept stationary by the tree; the remaining half rested on the surface, and enabled the sand to accumulate at its easterly side. Figs. 7 and 8 appear also to have been formed in a similar manner. They were found on that part of the shore between Ashbridge's Bay and the Scarboro' Heights. The dotted lines indicate what

Fig. 7.

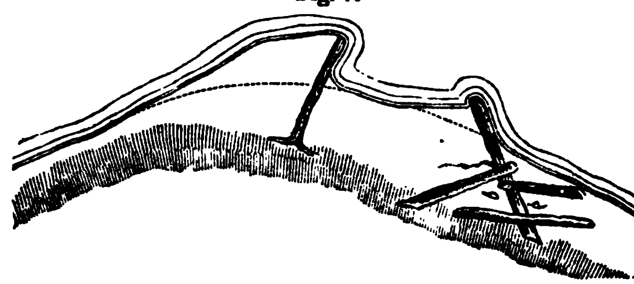
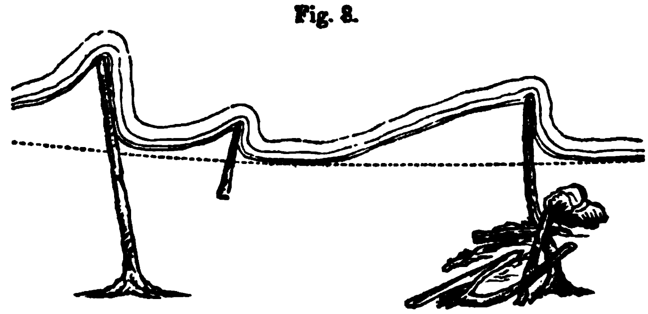


Fig. 8.



Sketches of natural Groynes.

was supposed to be the original water-mark. In all cases, the water was from one to two feet deep on the westerly side of the logs, and in several instances the sand was five or six inches above their upper surface on the easterly side. These groynes, formed by accident, show very clearly the results of the westward motion of the beach, and, although simple in the extreme, are natural models from which may be designed other contrivances for the retention of the moving sand, and will be referred to hereafter in treating of the preservation of the Harbour.

In addition to these indications of the westward motion of the beach, it may be observed that, on an examination of the mouth

of several small streams discharging into the lake east of Ashbridge's Bay, it is found that, whatever be their general direction inland, so soon as they intersect the sand beach, their course is westward. In most cases they run parallel to the shore, separated from it by a small ridge of sand, and ultimately discharge into the Lake some distance west from the point where they leave the woods.

We have also palpable and positive proof of the westward motion of the beach in the extension of the Peninsula itself in that direction. Joseph Bouchette, late Surveyor-General of the Province, made a survey of Toronto Harbour in 1796, a reduced plan of which was published in 1815 along with his work on Canada. At the date of the survey, that part of the Peninsula on which the light-house is erected was then the margin of the lake. Since that time, one sand ridge after another has been washed up, until now, after a lapse of only fifty-four years, a tract measuring upwards of thirty acres has been added, and the Lake is now distant from the light-house about eighteen chains.

The general appearance of this recent addition to the Peninsula resembles so closely other older portions, and its geological character is so clearly identical not only with the adjacent parts, but also with the whole formation, that we may very properly infer they are each and all produced by the same causes. Admitting, then—and it is indisputable—that this enlargement of the light-house point is due to the progressive motion of the beach sand through the mechanical agency of the waves from the eastward, we come to the conclusion that the whole Peninsula is the result of the same action, continued through past ages, and traceable to the same eastward source.

Arrived at this conclusion, we are now naturally led to enquire whence has the abundant supply of material for so extensive a deposit been obtained. About five miles east of Toronto, a high bluff, known as the Scarboro' Heights, stretches along the shore for several miles. The bluff is about three hundred feet high, and is chiefly composed of sand, with at intervals a stratum of clay. It is known by the farmers residing in the neighbourhood to recede ten or twelve feet annually at the present day. Farther eastward, the coast has a low aspect, and is of a soil capable of providing but little of the substances of which sand and gravel beaches are composed. Moreover, by contouring the country bordering on this high cliff, it is found that the lines betoken a former great projection lakeward, of which Fig. 9 (see plates) is an ideal outline, and Fig. 16 a sectional sketch on the line K L, at right angles to the shore. For these reasons, then, we are induced to fix upon this point as the locality from whence has been drifted the materials forming the deposit in question.

Founded on demonstrative and probable evidence, here in part set forth, I will now venture to lay before you what I believe to be a correct theory of the gradual formation of that singular deposit which has provided for Toronto so good a harbour.

On the subsidence of Lake Ontario from a high to its present level, the land fell in easy slopes to the water's edge, and the gradual, descending surface-lines were continued outward under water; the abrupt terminations of the land along the boundary of the lake having been formed by its encroachments through a long course of ages, the promontories which formerly projected have been rounded off by the destructive influence of the elements. The sand and clay of which they consisted, and which lay between the ancient and present margins of the water, having been removed to other parts, the clay carried out and stratified at the bottom of the lake, and the sand formed into new deposits, kindred to the one under discussion.

Referring to Fig. 16, we have an illustration of this as applied to the Scarboro' Heights. K represents the present position of the cliff, and L the supposed former shore of the lake, the point of land extending from K to L, Fig. 9, having been removed by the waves.

Figs. 9, 10, 11, 12, and 13 are sketches of the deposit at several periods prior to and during its formation. The first shows the supposed original outline of the lake immediately after its subsidence, prior to any encroachments or changes of the shore line; the second, a small spit running westerly from the Scarboro' promontory; the third and fourth, farther extensions of this spit, and wearing away of the promontory. At this period (Fig. 12) the River Don has brought down a large quantity of drift from its valley, as explained in the first part of this paper, and the lake deposit is now going on over the shoal water. Only a small portion of the spit thrown up at this period now exists, the remainder having been encroached on and moved westerly as the heights at Scarboro' receded. The portion referred to is a narrow ridge running landward to the west of the Don. It may now be seen stretching from near the wind-mill outward, and separating the marsh from the harbour.

Fig. 13 shows still farther encroachments on the land at Scarboro', the almost entire removal of the spit shown by Fig. 12, and the advancement of the Peninsula westward.

Fig. 14 represents the present state of the deposit. The dotted lines are contours (explained on the plate) showing the rapid progress of the shoal landward at the western boundary of the Harbour. Its edge between the point of the Peninsula above water, and the mainland, at the Queen's Wharf, may be taken at the ten feet water-line, within which it immediately rises, and gives a depth of about four feet only along the eastern side, and from six to thirty inches along its western boundary.

Figs. 17, 18, 19, and 20 are sections across the Harbour and Peninsula, on the lines G H, E F, C D, and A B, drawn on Fig. 14. These show clearly, without unnecessary explanation, the nature and limits of the deposit. Fig. 20 runs from the foot of George Street southerly, through that point of the Narrows proposed for the eastern entrance to the harbour, hereafter mentioned; Fig. 19 on a line parallel to the first, from the Parliament Buildings southerly; Fig. 18 from near the Queen's Wharf directly across the shoal at the entrance: this, as well as the last, cuts several of the many ridges of sand, with long narrow ponds between, by which the upper surface of the formation is characterized. Fig. 17 runs from the old French fort parallel to the other sections, intersecting no portion of the deposit, but passing very close to its western limit at the Light-house point, in sixty feet water. The depth of water, increasing as the deposit was extended westerly, accounts very satisfactorily for its spreading so much towards the north. Although an equal amount of sand may annually have been brought forward, yet, as the deposit was forced out into increasing depths of water, this rate of extension westerly would in proportion be diminished, thus allowing the southerly waves more and more time to act in moving the deposit towards the north.

In the manner above explained, it is argued that the Peninsula has been formed, is still undergoing great changes, and is even now receiving large annual additions from the same source. It seems, too, from what will shortly be laid before you, that the same natural agents which have raised up a breakwater, and formed one of the most capacious harbours on the Lake, are

as actively engaged in its destruction, by fencing in, as it were, the whole smooth water basin they have made, and justify the inference that, if left entirely to themselves, will at some future period unite the Peninsula to the mainland west of the Queen's Wharf, in the same manner as it was originally connected by the ridge from near Privat's to the Wind-mill. This stage of the deposit is illustrated by Fig. 15, at which period the surplus water of the Don would in all probability find egress over the bar by a shallow channel, fluctuating in position as well as depth during every southerly gale, or by such gaps as are occasionally opened in the narrow belt of sand separating Ashbridge's Bay from the main Lake.

The progressive motion of the beach, observable only on close examination, and apparently of little moment, is when continued during incalculable periods of time, thus proved to be productive of very extraordinary results. Nor is it confined to this neighbourhood, for we discover unmistakeable indications of its operations along the shores of all the great inland lakes.

Round Lake Ontario its effects can be traced at Burlington Beach, the mouth of the Niagara River, Presque Isle, Cobourg, Port Hope, Windsor Bay, and at innumerable points along the east and south boundaries of the Lake.

Round Lake Erie we see its results at Sandusky Bay, Point aux Pins, Long Point, Port Colborne, Buffalo, and at Erie.

At Saganaw Bay, Thunder Bay, Riviers Aux Sable, north and south, at Nottawasaga, and the Christian Islands, on Lake Huron.

Round Lake Superior we also have many examples of a like kind; at Fond du Lac, a gravel beach resembling in a marked degree, both in appearance and position, the Burlington beach near Hamilton. At the mouth of the Bad River, and at Point Iroquois, also, are found beach formations.

Many of these closely resemble in outline the Peninsula at Toronto. Some of them are kindred to the hypothetical stage denoted by Fig. 15; all of them are identical in geological character, and exemplify the workings of one of Nature's ever active agencies, co-existent and co-extensive with the lakes themselves. One fact which very strongly confirms the theory of the formation of the Peninsula here propounded, is worthy of notice: all the examples above mentioned invariably conform with the rule laid down—the trend of the deposits bearing in a direction opposite to the longest fetch of the waves, or the largest area of open water traversed. The entire absence of boulders is also very remarkable, and whenever gravel forms part of the drift, the largest sized is generally found nearest its source, the finest kinds being at the greatest distances. This circumstance is explained by Fig. 2, and the accompanying remarks, which show that small bodies are moved onwards with the greatest facility. Large boulders, in consequence of being able to resist the mechanical force of the waves remain at rest, and therefore can form no part of beach formations.

To arrive at a knowledge of those changes more particularly referred to, which have taken place on the shoal at the mouth of the harbour, I have with permission carefully examined the old maps and charts in the Surveyor-General and Ordnance Departments; many of them are wanting in detail, and in this respect of little service to the enquiry; others are of considerable value, the most reliable of which appear to be the charts of Bouchette, Bayfield, and Bonnycastle, dated respectively 1796, 1828, and 1835; for although they do not profess to much nicety of detail, yet emanating from these sources we have no reason to doubt their general accuracy. Fig. 2 shows the position of the shoal at the several dates of these charts, and as it now exists; the soundings have reference to its present state. I have much to regret being as yet unsuccessful in procuring a copy of one very old chart, the possession of which would be invaluable, seeing that it is without doubt the earliest record of Toronto Harbour in existence. This chart is said to have been made by a corps of engineers who accompanied the first pioneers from France nearly 200 years ago. A copy, perhaps the only one on the Continent, was unfortunately destroyed with the Parliament Buildings in Montreal, in 1847; the original is supposed to be deposited in a Jesuit College in Paris.

On comparing the charts of Bouchette, Bayfield, and Bonnycastle, with my own from a recent survey, showing the state of the Peninsula at the present time, we obtain results as follows:—

First, that the channel between ten feet water lines was,

In 1796	about	480	yards wide.
" 1828	"	310	"
" 1835	"	260	"
" 1850	"	120	"

Second, that the quantity of sand deposited at the south side of the entrance by an approximate estimate is as follows:—

From 1796 to 1849–50 nearly 660,000 cubic yards, being in 53 years about 12,400 yards per annum.

From 1828 to 1849 nearly 235,000 cubic yards, being in 21 years about 11,200 yards per annum.

From 1835 to 1849 nearly 155,000 cubic yards, being in 14 years about 11,000 yards per annum.

The alarming progress of the shoal landward is from these figures very apparent. Fifty-three years ago the entrance is shown to have been four times its present width, and fourteen years ago more than double, thus decreasing at the rate of from seven to ten yards annually, by the deposit of about 11,000 cubic yards.

If such be the case, and it is founded on the most authentic information relative to the past condition of the Harbour as yet in our possession, we have substantial reasons for believing that if left unheeded it will in ten or twelve years be inaccessible except to the smallest craft.

The extension of the shoal may be attributed to the same causes which are proved to have formed the whole Peninsula. The beach sand having reached the Light-house point cannot by reason of the great depth of water, as shown by the contour lines, Fig. 14, make much progress in extending the Peninsula from thence westerly; there is therefore nothing or at least not much to prevent the southerly waves from acting in full play, they having a fetch of forty miles in opposition to the northerly immediately off the land, and washing along the bar (scarcely under water) towards the north "dump," as it were periodically, large quantities of sand into the channel.

Certain outward and inward currents occasionally exist at the entrance, caused probably by gales slightly varying the level of portions of the lake, or, as it is also supposed, by local variations of the atmospheric pressure on its surface; these may assist to a limited extent in prolonging the existence of the channel, but from all the observations I have as yet been able to make, they appear to be surface currents only, having little or no appreciable effect five or six feet under water; even this supposition therefore is very problematical.

ITS PRESERVATION.

Having by sufficient evidence set forth the probability if not the certainty of an early destruction of the harbour by the damming up of its entrance, we may now proceed to the practical, and, so far as the commercial interests of Toronto are concerned, the vitally important part of the inquiry, and endeavour to obtain a satisfactory answer to the query—How can such a catastrophe be obviated or indefinitely postponed? A problem which becomes of comparative easy solution when the immediate cause of the evil is set beyond a doubt, and the nature of its operations clearly ascertained.

To keep those harbour channels subject to obstruction from moving sand-bars in a navigable condition, three expedients are generally resorted to: First, continuous or periodical dredging; second, the application of a scour to remove the bar as it is formed; third, the construction of such works as are calculated to prevent the deposition of the sand in the channels, by retaining it at a distance, when its source is known, or by diverting it to those points where depth of water is not essentially necessary.

The first is often applied as a temporary remedy, and as such may at times be viewed as a fit expedient, but to employ it as the lasting counteracter of a constantly increasing evil, is to adopt an indubitable source of unceasing attention and endless outlay; it should accordingly be dreaded as a permanent restorative, and employed only by compulsion from unusual difficulty in the application of other measures that are generally less costly and always more satisfactory.

The second is obtained at *marine* ports by taking advantage of the tidal fluctuations, and is generally produced twice each day by using the currents of rivers at low tide, or by holding up the sea water in large artificial basins at flood, then concentrating and guiding it to the bar at ebb. The impracticability of procuring a scour on Lake Ontario from tidal fluctuations must be admitted, since practically there are none; true it is we have a gradual rise and fall of about two feet annually, and at times successive oscillations in level to the extent of several inches, much resembling small tidal waves; but the latter, although they give to the surface water at the entrance of the harbour a perceptible current, are too rare and too feeble to be of any real value. Nor have we at Toronto a river sufficient for the service, for the Don has hitherto failed to keep open its own channel to a greater depth than two or three feet. Indeed I feel quite convinced that all attempts on these inland waters to keep permanently open those harbour channels much exposed to beach drifts by other than the largest class of rivers must sooner or later prove ineffectual. The currents of the Nottawasaga, of the Sable, and of the Saugeen, are unable to keep open to a sufficient depth or width the mouths of those rivers, and yet they are in volume from ten to twenty times greater than the Don.

The third remedy can always be advantageously employed in cases when the obstructions are the natural results of moving beaches, and when the works are located and executed with proper care they usually answer a good purpose; the second is often after great outlay under favourable circumstances of doubtful efficacy. In the case of Toronto, even if we had at command a current capable of removing the sand on its arrival at the point of the shoal, I question very much if it should be considered as more than an auxiliary, since it would of necessity tend to spread the deposit, and thus, although injuring the channel in a less degree, would impair the harbour generally by lessening in depth the approach to it. Without doubt the steps likely to confer the greatest security, and hence the most advisable to be taken, are those which are calculated to keep the drift at a distance from that point where it is not wanted.

I therefore beg leave to submit for your consideration the following preventive and remedial measures:—

1st. That a Groyne should be constructed at the Light-house point from the shore outward to 8 or 9 feet water for the retention of the moving sand, on the principle of those very simple natural ones shown by Figs. 6, 7, and 8.

2nd. That an auxiliary Groyne be run westerly across the outer edge of the shallows, a little to the south of Gibraltar point.

3rd. That a Pier or breakwater be built along the south side of the channel as shown on Fig. 21, increasing the navigable water to six hundred feet, by cutting off the point of the shoal north of the proposed line of pier.

The third alone would probably suffice for many years to keep the channel perfectly free from deposit; but the sand, if not retained at the Light-house point, would as at present be moved northward by the southerly waves, and would gradually accumulate to such an extent as to fill up the whole space along the south side of the pier until ultimately rounding its extremities. To effectually prevent this the first and second should also be constructed, the first would divert the drift westerly into deep water, where the navigation could never practically be obstructed; and the second groyne placed about midway between the first and third would have the effect of counteracting all progressive action along the west end of the Peninsula.

If the destruction of the Harbour entrance, and the formation of the Peninsula generally, be satisfactorily determined, I think it is equally conclusive that these works, or works of the same character, would, if established in due time, be exercised to a very beneficial result,—the preservation of the Harbour for an indefinitely long period.

There are other evils, which, if they affect the salubrity of the city more immediately than they prove detrimental to the Harbour, are not on that account of the less consequence. The Don annually transports even at this day considerable quantities of silt from the interior of the country to the Marsh, and, during freshets, a portion escapes from thence into the harbour through the openings in the beach between the Wind-mill and Privat's, tending of course, when deposited in the basin, to lessen its depth. All the drains and sewers empty into the bay, making it, in truth, the grand cess-pool for a population of probably 30,000 inhabitants, with their horses and cattle. The sewers of necessity bring down no inconsiderable portion of solid matter, impairing greatly the purity of the water in the Harbour, as well as gradually lessening its depth. This evil, increasing in a proportionate ratio to the growth of the city, might be greatly ameliorated, if not almost totally removed, by the construction of a main sewer along the whole city front eastward to the Marsh. Into this sewer all the lateral ones from the north, and the drainage of gas, chemical, and other such like works, should be made to discharge. The feculent mixtures produced would thus be collected and conveyed to a distant point, where, by similar operations to those now ripening in Britain, which will strip them not only of their noxious, but even of their offensive characters, might be profitably converted into a marketable commodity of the highest value to the farmer.

The prejudicial effect of the Don on the depth of the Harbour may also be destroyed by closing its present outlet, and forming an opening of sufficient capacity in the beach separating the main Lake from Ashbridge's Bay.

All proposed works relative to the improvement of the harbour

should be carefully considered before any be proceeded with, lest some of them may interfere with preservative measures, or the general improvement of the whole. It may not be out of place, therefore, to consider briefly another proposition, which, for many years past, has engaged public attention perhaps more than any other in connection with the Harbour, viz., the forming of an eastern entrance.

Judging from the following paragraph, extracted from the *Courier* newspaper, dated 5th March, 1835, the project was seriously talked of fifteen years ago:

"CUT ACROSS THE PENINSULA.—A respectable meeting of the friends to this measure was held on Thursday evening at the Commercial Hotel, when a Select Committee was appointed to request the Governor to name an Engineer, and also to request the Mayor and Corporation to name another, to meet him for the purpose of reporting on the probable result of the cut. The Committee waited on His Excellency this morning, who very readily named Captain Bonnycastle, at the same time expressing a hope that a measure so adapted to promote the health of the city would be carried into effect. His Excellency also promised to do all in his power to put the entire Marsh at the disposal of a company, with a view to its being reclaimed as far as it is possible to do so. There is every reason to expect that the Corporation will take the same view of the case; and if the report of the Engineers shall be favourable, a number of wealthy merchants and others in the city have expressed their intention to take up a sufficient quantity of stock to complete the undertaking."

A few months thereafter, the following was gazetted amongst the Notices of Public Improvements:—

"TAKE NOTICE.—The Inhabitants of the City of Toronto will make application to the next session of the Provincial Parliament to incorporate them into a Company for the purpose of opening a Ship Navigation through the neck of the Peninsula between the Lake and the Bay of Toronto.

"Toronto, August 1st, 1835."

It is unnecessary to say that the contemplated improvement has not been carried out. The spirits of the projectors were probably damped, and their stock-book laid aside, after the opinions of the engineers appointed to examine were made public. I have only been able to obtain the perusal of one of these documents, but am informed that the report of the gentleman appointed by the Corporation was even less favourable.

Captain Bonnycastle says, relative to cutting a navigable canal through the Peninsula:

"If this should be done without due consideration, the barrier which Nature has interposed for the preservation of a Harbour formed probably by the cutting action of the Don when it was a larger river, which it only requires to look at its banks to convince one's self that it anciently was, will be thrown down, and the Harbour entirely destroyed.

"The reasons to be assigned for this opinion are as follows:

"The southern face of the Peninsula, a low ridge of sand, is bordered to some distance out, excepting near the Narrows, by large and fluctuating shoals, well known to the fishermen, who have so recently established a profitable trade on them.

"The force of the easterly and westerly gales on these shoals and the bounding shore is tremendous, as every person in Toronto has frequent opportunities of hearing, even at the great distance which the city is from them.

"Should a navigable canal, without due restrictions, be cut through the slender belt which divides the waters of the Lake from the basin, all the millions of tons of large shingle, small rounded and angular fragments of granite and other hard rocks which line the beach will be put in motion!—will break down by their erosive power any barrier opposed to them!—will carry before them the whole extent of the Narrows, and perhaps penetrate through the ponds, fill the basin, and convert it into a fresh sand bank." This he goes on to show might be produced by a current through the canal, and further states, "It might in fact tear away all the strip of beach along the western or bay shore of the great Marsh, and let the whole of that body of the mud of Ages into the Basin.

"It is argued that all this may be avoided by running out extensive piers into the Lake, and forming a strong embankment along the Ontario face of the Narrows. These, if placed in such situations as to break off the strength of the easterly or westerly swells, will do much towards it, but it will be also necessary to make the canal of stone, to puddle its sides to a considerable thickness or extent, to make it narrow, and to place gates both at its entrance and exit.

"With these precautions there can be no harm in trying the experiment."

Although entirely concurring with Captain Bonnycastle in the expediency of closing up the present outlets of the Don, and of conveying the whole sewage of the city to the Marsh; yet having already, with all due respect, expressed my reasons for differing from the view he takes of the formation of the Harbour, and since conclusions on this point affect directly and very materially the consideration of all works of improvement immediately connected with the Peninsula, I may also be permitted to entertain opinions not altogether coinciding with his as to the probable effects of the proposed south-eastern entrance, and its mode of construction.

Knowing the nature of the action of the beach at the proposed site of the canal, and I think it is established beyond a doubt, there can be no possible danger of any part of the Peninsula being torn away, or the basin within being filled up with sand, if proper steps be taken to counteract such action. This action is chiefly the progressive motion of the beach, which would effectually be suspended for many years by the piers of the canal themselves, constructed with crib work in the ordinary manner. The canal need neither be narrow, as suggested, nor provided with gates, since the former would increase the danger in entering, while the latter would add to the cost and inconvenience, and no benefit could result from either.

Fig. 22 shows the proposed position of the canal. Its extreme length, from 13 feet water in the bay to 17 feet in the Lake, is 1600 feet, with a width of 300 feet. The eastern pier, presenting an obstruction to the motion of the beach westward, would, acting as a groyne, retain it permanently at its eastern side; the western pier, on the other hand, would be exercised to a similar result in suspending the retrograde motion. The sand gradually accumulating in the space north of the lines A B and D C would thus strengthen the Peninsula at its weakest point, and remove any danger which may be feared from the destruction of the narrow separating ridge between the Lake and the Harbour. The entire destruction of the Isthmus, although hypothetical, is nevertheless a contingency advisable to guard against. Openings have repeatedly been forced through the ridge bounding Ashbridge's Bay by gales point blank on the beach: these, having a destructive action only, might produce a similar result here. If at the same period the base of the Scarboro' Heights became partially protected from the fury of the waves by the lodgment of an unusual number of trees, or the falling of boulders from the cliffs above, the supply of sand from the east would for a time be diminished, the gap would remain open, and liable to be widened by every southerly wind. The Peninsula would thus be converted into an island, resembling its kindred formation "Long Point" on Lake Erie.

Through course of time (roughly estimated at about 20 years) the sand accumulating east of the canal would reach the line A B and ultimately round the piers. Then it would be necessary to make another provision for its retention. A groyne on the line G F would effect this object, and retain the sand for another period, until it reached as far as the line E F. The canal might thus be kept open by repeating the construction of groynes like E F and H K, *ad infinitum*, from time to time as necessity required; or the same purpose may be effected by simply extending the eastern pier as the sand accumulated outward along its eastern side.

The canal, having thus the effect of widening the Isthmus and removing all probability of its destruction, would, besides being a great accommodation to sailing craft in adverse winds, and to *steam vessels at all times* likely enough prove of service in another respect. The purity of the water in the bay is ever liable to be impaired by the vessels in dock, and its close proximity to the city. The canal would provide an additional opening for the ingress and egress of the slight tidal waves formerly referred to, doubtless presenting greater facilities for the renewal of the water in the harbour on its occasional fluctuations in level.

From certain simple and well-established premises it has been my purpose to draw reasonable conclusions, which in recapitulation may briefly be stated as follows:—

First, That the foundation of the Peninsula enclosing the harbour may be attributed in its early stages to the debris of the country traversed by the Don, in conjunction with a drift from an ancient promontory at Scarboro'.

Second, That the drift from Scarboro' has supplied and gradually deposited the main part if not the whole of the materials composing the more recent portions of the formation.

Third, That the drift is in consequence of the singular progressive action given to sand and gravel beaches under certain circumstances by the waves.

Fourth, That the harbour is daily being impaired by its chief agent of formation, and that its only entrance is threatened with early destruction by the same cause.

Fifth, That its preservation may be permanently effected by the construction of groynes at well selected points.

Sixth, That the dangers to be feared from the silt of the Don and sewage of the city although remote, would, taken in conjunction with the increasing deleterious effects of the latter on the water of the harbour warrant their total exclusion.

Seventh, That the construction of a south-eastern entrance would be a great accommodation to the shipping, may improve the purity of the Bay water, and, if properly executed, have no effect in lessening its depth; but would only assist in the preservation of the harbour so far as its piers, acting as groynes might retard the sand, widen the narrows, and thus strengthen the weak point of the Peninsula.

Although the preventive and remedial measures are founded on what I believe to be correct deductions, yet, seeing that they differ materially from those advanced by others who have considered the subject, they are presented on that account with some degree of timidity. I purpose, however, with the view of either confirming or modifying the conclusions arrived at, to continue a series of observations, carefully noting the various changes going on; and will if deemed worthy, take much pleasure in laying the results of such observations before the Institute at a future time.

Mean results of Meteorological Observations, made at St. Martin, Isle Jesus, Canada East, (nine miles west of Montreal) for 1853.

BY CHARLES SMALLWOOD, M. D.

(*The geographical co-ordinates of the place are 45° 32′ N. Lat., and 73° 36′ W. Long. Height above the level of the sea,* 118 *feet.*)

Barometric Pressure.—The readings of the barometer are all corrected for capillarity, and reduced to 32° F. The means are obtained from the three daily observations, taken at 6 A.M., 2 P.M., and at 10 P.M.

The mean height of the barometer in January was 29·757 inches, in February 29·654, in March 29·584, in April 29·654, in May 29·644, in June 29·648, in July 29·479, in August 29.598, in September 29·325, in October 29·500, in November 29·637, and December 29·456 inches. The highest reading was on the 28th of January, and indicated 30·382 inches; the lowest was also in January, on the 24th day, and was 28·638 inches; the yearly mean was 29·578 inches, the mean yearly range was equal to 0·993 inches. The atmospheric wave of November was marked by its usual fluctuations, the final trough terminated on the 30th day.

Thermometer.—The mean temperature of the air, by the *standard* thermometer, was in January 16°·68, in February 16°·36, in March 29°·68, in April 41°·36, in May 56°·34, in June 68°·66, in July 68°·04, in August 68°·61, in September 58°·04, in October 43°·37, in November 31°·00, in December 16°·57. The highest reading of the *maximum* thermometer was on the 16th of June, and marked 99°·2; the lowest reading of the *minimum* thermometer was on the 27th of January, and was—28°·7 (below zero). The mean temperature of the quarterly periods was Winter 19°·22, Spring 42°·46, Summer 68°·43, Autumn 44°·10. The yearly mean was 42°·89, and the mean yearly range 59°·27. The greatest intensity of the sun's rays was in August, and indicated 143°·6, the least intensity was in January, and was 64°·0, and the lowest point of terrestrial radiations was—22°·1 (below zero) in December.

The mean humidity (staturation being 1·000) was, in January .909, in February ·906, in March ·881, in April ·858, in May ·895, in June ·739, in July ·727, in August ·741, in September ·834, in October, ·855, in November ·798, in December. ·759. The yearly mean was ·825.

Rain fell on 99 days, amounting to 44·201 inches and was accompanied by thunder and lightning on 17 days. The greatest amount of rain which I observed, fell in September; it commenced at 5·10 P.M., on the 14th, and continued until 5·40 P.M., on the 15th and amounted to 5·142 inches. I have only observed once, this year, a yellow matter fall with the rain, and that was on the 24th day of September. It was without thunder or lightning, but was accompanied by slight hail. *Snow* fell on 37 days, amounting to 116·81 inches on the surface. The first snow of the winter 1852–3 fell on the 17th day of October, 1852, and the last fell on the 14th day of April, 1853; the whole amount of snow in the winter 1852–3 amounted to 119.10 inches. The river Jesus was frozen on the 28th day of November. The last steamer left Montreal (on the St. Lawrence) on the 7th of December; the first steamer arrived at Montreal on the 15th day of April. The winter fairly set in on the 18th day of December.

The amount of evaporation was measured regularly from the 1st of April to the 31st of October, and amounted in

April to 1·80 inches, in May 2·51 inches, in June 3·41 inches, in July 3·98 inches, in August 3·16 inches, in September 2·23 inches, in October 2·31 inches. This period includes what I consider could be taken with anything approaching to accuracy, owing to frosty weather.

The most prevalent wind during the year was the W. S. W. least prevalent was the E; in the winter quarter the most prevalent wind was N. E. by E., and the least S.; in the spring quarter the most prevalent wind was N. E., and the least so S.; in the summer quarter the most prevalent wind was W. S. W., and the least N.; in the autumn quarter the most prevalent wind was W. N. W., and the least E. The greatest velocity of the wind was on the 14th day of March, and was 32·60 miles per hour. The yearly mean of the maximum velocity was 15·81 miles per hour, the yearly mean of the minimum velocity was 0.32 miles per hour. The quarterly means were as follows: winter, maximum velocity 17·93, minimum velocity 0·25; spring, maximum velocity 16·68, minimum velocity 0·81; summer, maximum velocity 11·23, minimum velocity 0·29; autumn, maximum velocity 16·13, minimum velocity 0·18 miles per hour.

Crows were first seen on the 7th day of March, wild geese *Anser Canadensis*, on the 30th day of March, swallows, *Hirundo rufa*, were first seen on the 1st of April; shad, *Alosa*, were first caught in this neighbourhood on the 30th of May; fire-flies, *Lampyris corusca*, were seen on the 10th day of June: frogs, *Rana*, were first heard on the 23rd of April.

The Aurora Borealis was visible on 39 nights as follows:

January 12th, 10 P.M. Faint auroral arch, dark segment underneath.—13th, 10 P.M. Idem, *Zodiacal light*, bright.

February 1st, 10 P.M. Faint auroral streamers.—8th, 4 A.M. Faint auroral light.—14th 10 P.M. to daylight. Bright auroral arch.—20th, 10 P.M. Faint auroral arch. *Lunar halos* were visible on two nights during this month.—*Zodiacal light* was very bright also on 5 nights.

March 8th 10 P.M. Faint auroral light to horizon, occasional streamers. *Zodiacal light* still visible and bright.

April 1st, 9 P.M. Low auroral arch, dark segment underneath; 10 P.M., streamers, segment vanished.—5th, 9 P.M. Zenith clear, N. W., horizon clouded with *strati*, Aurora Borealis faint; 9·30, auroral arch 40° high, dark segment underneath at the horizon.—6th, 8 P.M. Faint low arch; 9 P.M., arch 20° broad, dark segment underneath: 9·40, streamers in N. W., of a yellow green color; 10·30, streamers extending to the zenith.—10th, 9 P.M. Low faint auroral arch. *Zodiacal light* very bright on 5 nights during this month.

May 1st, 10 P.M. Faint auroral light.—2nd, 8·40 P.M. Splendid display of clouds of auroral light forming a distinct arch stretching from the Eastern to the Western horizon, apex of the arch passing the zenith, extending through the constellations *Bootes* and *Leo*; 9 P.M., auroral clouds in the N. W., low and very near the horizon, arch very faint; 9·5, arch resumed the same brilliant appearance as at 8·40; 9·10, the whole of the Eastern and Western heavens were lighted up with a splendid display of auroral clouds, assuming various shapes and colors from yellow to crimson, arch disappeared; 9·30, all vanished.—4th, 9·10 P.M. Low auroral arch, dark segment underneath, occasional streamers.—30th, 10 P.M. Low faint auroral light to the horizon. *Lunar halo* visible on the 20th, diameter 63°.

June 14th, 9 to 10 P.M. Auroral streamers, moderate brightness, dark segment underneath.—30th, 10 P.M. Faint auroral light.

July 10th, 9 P.M. Auroral light, dark segment, occasional streamers; 10 P.M., dark segment and streamers vanished.—11th, 11 P.M. Faint auroral light to the horizon.—12th, 10 to 11 P.M. Streamers to the zenith, extending from N. N. W. to E.—18th, 1 to 2 A.M. Low dark arch of auroral light, moderate brightness, occasional streamers.—23d, 10 P.M. Auroral streamers of moderate brightness.—26th, 10 P.M. Faint auroral arch.—27th, 10 P.M. Auroral light to the horizon, splendid streamers. Shooting stars numerous during the month.

August 7th, 10 P.M. Faint auroral streamers, dark segment in the North.—25th, 10 P.M. Faint streamers, of auroral light.—31st, 10 P.M. Faint auroral light. Shooting stars numerous from the 6th to the 13th. Comet first seen here on the evening of the 22d day, in the constellation *Leo*, at $8^h\ 20^m$ M. T., R. A. $11^h\ 30^m\ 10^s$, Declination N. 20°·5.

September 1st, 8·50 P.M. Splendid display of auroral clouds, forming four distinct arches, of about 3° in width, with dark segments between, stretching from E. to W., from a point centered as it were in *Arcturus*. The most southern arch passing at its zenith through *Aquila*, the next through *Lyra*, the next through *Polaris*, under which was a dark segment, from which were sent up frequent streamers. These appearances continued with slight intermissions in intensity of color, from 8·50 till 9·50 P.M. The southern or superior arch remained the longest time visible. The northern horizon was lighted up for some time, but faint (until 10·5). Stars of low magnitude were visible through these appearances.—2d, 8·50 to 11·40 P.M. Much the same appearance as last night, but the arches not so well defined. The most southern arch was several degrees south of zenith. Many floating auroral clouds extending from E. to W.—3d, 7·30 P.M. Auroral arches again seen this evening, only two in number, the most southerly a little N. of *Polaris*, very dark segments in the N. to the horizon, occasional streamers.—12th, 10 P.M. Faint auroral light.—18th, 10 P.M. Faint auroral light.—24th, 10 P.M. Faint auroral arch, dark segment underneath.

October 23rd, 10 P.M. Faint auroral light.

November 9th, 10 P.M. Floating auroral clouds—very high wind.—27th, 10 P.M. Faint auroral light to the horizon. *Zodiacal light* very bright and well defined apex at *a Leonis*, (Regulus.) Base in East very extended.

December 4th, 8 P.M. auroral light bright to the horizon.—20th, 10 P.M. Auroral arch; no dark segment.—28th, 10 P.M. Low auroral light to the horizon.

Electrical state of the atmosphere.—The atmosphere has *daily* afforded indications of electricity varying in intensity, and kind: the highest tension has been *generally* noticed in the winter season; the tri-daily observations (which could not be condensed) would occupy too much space for the columns of this *Journal*.

Ozonometer.—Observations have been carefully registered twice daily, for some years, of the amount of ozone present in the atmosphere; the slips of iodized paper are carefully preserved in a dark place after having been exposed to the atmosphere, shaded from the sun, and rain. As a general rule, rain or snow shows an increase, and so far as my own observations go, a high electric state of the atmosphere *does not* show an increase in the amount of ozone.

St. Martin's January, 25, 1854.

CANADIAN INSTITUTE
ESTABLISHED 1849

INCORPORATED BY ROYAL CHARTER.

Eleventh Ordinary Meeting, March 4th, 1854.

David Buchan, of Toronto, was proposed for membership.

A donation from James Bovell, M.D., of various mineralogical specimens from Barbadoes, was announced.

A paper, written by Thos. Cottle, M.D., of Woodstock, was read by Professor Croft, the subject of the paper being "Canadian Saturniæ, with suggestions on the possibility of using their Silk for textile purposes." A number of fine specimens of Canadian Saturniæ from Professor Croft's private collection were on the table.

James Bovell, M.D., read a paper "On the Re-production of the Digestive Organs of the Holothuria." The paper was illustrated by dissected specimens of the Holothuria from Barbadoes.

A paper was laid on the table by the First Vice-President containing a list of indigenous plants found in the neighbourhood of Hamilton, with the dates of their being found in flower and examined, by W. Craigie, M.D., and Mr. W. Craigie, of Hamilton.

Twelfth Ordinary Meeting March 11th 1854.

The First Vice-President announced a further donation from the eminent publisher, H. G. Bohn, Esq., of London, of fourteen volumes of *Bohn's Standard Library*.

The thanks of the Institute were ordered to be presented to Mr. Bohn for his valuable donation.

John J. Macauley, of Toronto, was proposed for membership.

David Buchan, of Toronto, was elected member of the Institute.

A paper written by Elkanah Billings, Barrister-at-Law, of Bytown, C. W., "On some new Genera and Species of Cystidea from the Trenton Limestone," was read by Professor Hind.

The Rev. Dr. McCaul, who was to have read a paper "On some doubtful points in Grecian and Roman Antiquities," having been unavoidably prevented from attending the meeting, Professor Wilson delivered a very interesting Lecture on "Traces of the Practice of the Medical Art amongst the Early Romans." Professor Wilson exhibited some wax impressions of Roman medical stamps found in Scotland.

Thirteenth Ordinary Meeting March 18th 1854.

The names of the following candidates for membership were read:—

The Rev. H. J. Grasett	Toronto.
James Ross	Belleville.
Loftus Turner, Jun. Mem.	Toronto.
Thomas Brunskill	"
W. W. Copp	"
T. C. Orchard	"
John McNabb	"

John J. Macauley, of Toronto, was elected member of the Institute.

A paper written by Major Lachlan, of Montreal, "On the establishment of a system of simultaneous Meteorological Observations, etc., throughout the British American Provinces," was read by the Rev. Professor Irving.

At the conclusion of the paper, it was moved by Professor Cherriman, seconded by Professor Irving, "that the subject of Major Lachlan's paper be referred to the Council, and that a Committee be named by the Council in accordance with Major Lachlan's proposal."

Professor Hincks delivered a short Lecture on a peculiar vegetable parasitical production from South America.

Fourteenth Ordinary Meeting March 25th 1854.

The names of the following candidates for membership were read:

J. L. Wilkes	Brantford.
Thos. Maclear	Toronto.
Hiram Piper	"

The following gentlemen were elected members:

The Rev. H. J. Grasett	Toronto.
James Ross	Belleville.
Loftus Turner, Junior Member	Toronto.
Thomas Brunskill	"
W. W. Copp	"
T. C. Orchard	"
John McNabb	"

A communication from the Council was read by the Secretary, announcing that in accordance with the proposal contained in the paper by Major Lachlan, read at the last meeting of the Institute, they had nominated a Committee to take into consideration and report on the subject of Major Lachlan's suggestions.

The following gentlemen constitute the Committee: Professors Cherriman, Irving, Croft, Hind, Chapman, and Mr. S. Fleming.

A paper was read by the Rev. Henry Scadding, D.D., the subject being "Memoranda of Vesuvius and its neighbourhood."

Professor Chapman delivered a short Lecture on the tooth of the Elephas primigenius found in the River Credit.

The First Vice-President announced a second paper by Elkanah Billings, Esq., Barrister-at-Law, Bytown, "On some new Genera and Species of Cystidea from the Trenton Limestone," to be read at the next Ordinary Meeting of the Institute; also, a paper by Professor Wilson, entitled, "Some remarks on the intrusion of the Germanic races into the area of the older Keltic races of Europe."

Miscellaneous Intelligence.

Colonial Progress.—Official returns just published from the Province of Nova Scotia furnish another illustration of that extraordinary progress of the British colonies of North America which is rendered more striking from the little that has been said about it. Notwithstanding the losses sustained a few years back from the potato rot, all the great interests of the province exhibit revived activity; employment is general, and the revenue, under a tariff which is lower than any other on the American continent, yields a large surplus for educational purposes and internal improvements. Although in Nova Scotia the duty on imports is only 6½ per cent., while in Canada it is 12½, and in New Brunswick from 7½ to 30 per cent., the receipts increased from 54,179*l.* in 1849 to 98,039*l.* in 1852, while the accounts for the past year, when made up, are expected to be equally favourable. The exports for 1852 amounted to 770,780*l.*, and the imports to 1,194,175*l.*; and, although an adverse balance is apparently thus exhibited, it is explained by the shipments being valued at home prices, and by no estimate being included of the gains from freight obtained by the vessels of the colony. The actual trade is therefore one of extensive profits, and the augmentation in the staple articles of production, as well as in the mercantile marine, is such as to show a vigour of growth unsurpassed in Canada or the United States, or, indeed, in any part of the world. The number of vessels registered and actually employed in the fisheries and trade of Nova Scotia is now 2,943, with a capacity of 189,083 tons, and the rate of progress is on a scale to denote that at no distant day she is destined to be one of the largest shipping countries in the world. "She owns now nearly one-third as much tonnage as France. She beats the Austrian empire by 2,400 vessels, and by 69,000 tons; and owns 116,000 tons of shipping more than Belgium. She beats the Two Sicilies by 38,449 tons; Prussia by 90,783. Holland, which once contested the supremacy of the seas with England, now owns but 72,-640 tons of shipping more than this, one of the smallest of the British colonies; and Sweden, with a population of three millions, only beats Nova Scotia in shipping by 36,927 tons." At the same time, the comparison with the United States is also remarkable. Out of the 31 States which constitute the Union, there are only six (New York, Massachusetts, Maine, Pennsylvamia, Louisiana, and Maryland) whose tonnage exceeds that of Nova Scotia, and the last three of these she is likely to outstrip in the course of a year or two. Considering that the colony is only 100 years old, and that her population does not exceed 300,000, these results are beyond anything ever before witnessed. But it is not alone as regards fisheries and shipping that the energies of the people are manifested. The agricultural capabilities of Nova Scotia are great, and are being turned to good account. "With the wheat-growing countries that surround the great lakes, whether on the British or American side, she is not," it is remarked, "to be compared. She does not raise her own bread, but while one barrel of her mackeral will purchase two barrels of flour she can always afford to buy what she requires. It is curious, however, to discover that even as a wheat-growing country she beats five of the New England States and 12 of the more recently settled States and territories." In the growth of rye she is far ahead of 16 of the States and territories of the Union; in oats she exceeds 18, in hay 21, in buckwheat and potatoes 28, and in barley every State and territory except Ohio and New York. Under these circumstances, coupled with the fact that the province enjoys, in common with Canada and New Brunswick, the full development of representative institutions, it is evident that the prospects of its prosperity are unlimited.—*Times.*

Purification of Gas.—At the City Court of Sewers, held yesterday, Mr. Deputy Peacock was unanimously elected chairman for the ensuing 12 months. The attention of the Court was for some time occupied with inquiries as to the supply and purification of gas. The subject was introduced by a report from the Committee on General Purposes, to whom was referred a statement made by Dr Letheby, that he had found 21 grains of oil of vitrol in 100 cubic feet of gas. The committee recommended that Dr. Letheby should be allowed to proceed with certain experiments, with a view to test the quality of the gas supplied to the city of London by the various gas companies, and also to promote its purification. This suggestion of the committee was adopted. A report was then read from Dr. Letheby respecting the power and quality of the gas supplied to the city by the Great Central Company. This report stated, that during the last three months the power of the gas had been nearly 22 per cent. greater than was required by act of Parliament, and that the result of various experiments was highly satisfactory. The report then congratulated the Court upon having directed public attention to the purification of gas as one of the most important sanitary and commercial questions of the day. Nearly 4,000,000,000 cubic feet of gas were now annually consumed, of which about 500,000,000 were supplied to the city of London. The consumption of gas in London was nearly trebled since 1837, but hitherto nothing had been done to control the companies engaged in its manufacture. Coal gas was liable to be contaminated with four impurities calculated to injure the atmosphere; but, as science could furnish a remedy, and render the gas pure, the report suggested that those in authority should pay attention to the subject, as the use of coal gas "might become either the greatest curse or the greatest boon of the 19th century."—*Times.*

A New Effect of the Magnetic Telegraph.—The various wires of telegraphs beginning to intersect so many sections of our country are said to have a decided effect upon electricity. That eminent scientific man, Prof. Olmstead, of Yale College, states, that as the storm comes up, and especially when over the wires, say fifty or a hundred miles distant, the lightning is attracted by the wires; which can be proved by any one remaining in a telegraph office for half an hour. About the time the storm is coming up, the wires are continually filled with electricity. It is my opinion, he says, that we should never have heavy thunder showers, or hear of lightning striking so long as we have telegraph wires spread over the earth.—*American Paper.*

Photographic Light.—A novel application of the combustion of zinc has just been discovered by Mr. Wenham. He takes fine zinc parings or shavings, and forms them into a pellet. which, when ignited, affords a brilliant, and it is said, a steady light for photographic purposes.

Claussen's Flax Works.—According to the statements of the parties interested, the recent fire at Claussen's Patent Flax-works at Broomley occurred at the time when the company had fully succeeded in establishing the process, and when large orders were in progress. A fresh manufactory is to be formed as soon as possible.

Extraordinary Diamond.—The extraordinary diamond recently deposited at the Bank of England from Rio was submitted this morning to the Queen by the consignees, Messrs. Devoy and Benjamin. It weighs 254½ carats, and is alleged to be likely, when polished, to exceed in size and brilliancy the Koh-i-noor.—*Times.*

Substitute for Coffee.—Asparagus, according to Liebig, contains, in common with tea and coffee, a principle which he calls "Taurine," and which, by the way, he considers essential to the health of all who do not take strong exercise. Reading this led me to think that asparagus might be made a good substitute for coffee. The young shoots which I at first prepared were not agreeable, having an alkaline flavour. I then tried the ripe seeds; these, roasted and ground, make a full-flavoured coffee, not easily distinguishable from a fine Mocha. The seeds are easily freed from the berries by drying them in a cool oven, and then rubbing them on a sieve.—*Correspondent of the Gardener's Chronicle.*

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—February, 1854.

Latitude, 43 *deg.* 39.4 *min. North.* *Longitude*, 79 *deg.* 21. *min. West.* *Elevation above Lake Ontario*, 108 *feet.*

Magnet.	Day.	Barom. at tem. of 32 deg.				Tem. of the Air.				Tension of Vapour.				Humidity of Air.				Wind.				Rain in Inch.	Snow in Inch.
		6 A.M.	2 P.M.	10 P.M	Mean.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Mean Vel'y		
						°	°	°	°														
b	1	29·189	29·081	29·279	29·168	35·5	42·7	35·7	37·12	0·194	0·238	0·190	0·198	·94	·88	·91	·90	S W	W b S	Calm	3·92	Inap.	0·8
a	2	·450	·583	·714	·592	18·6	9·1	5·4	9·48	·094	·059	·049	·063	90	83	81	83	N N W	N E b N	N N W	10·03	...	1·5
c	3	·833	·732	·848	·805	—5·7	14·8	4·7	4·62	·029	·071	·045	·048	81	78	79	79	Calm	N E b N	N W b W	3·90	...	...
e	4	·958	·957	·902	·935	1·8	14·2	8·0	8·27	·045	·071	·054	·057	87	80	79	82	N W	W N W	Calm	1·97	...	1·0
b	5	·693	·512	—	—	16·9	19·5	—	—	·083	·092	—	—	84	88	—	—	S E b E	N E b N	—	6·77	...	1·0
a	6	30·087	30·082	30·098	30·079	—4·3	21·5	14·8	10·80	·028	·100	·074	·068	73	84	83	79	Calm	Calm	W S W	1·14	...	...
b	7	30·046	29·857	29·688	29·856	12·6	27·5	27·6	22·87	·071	·135	·120	·108	83	89	79	83	Calm	E b S	S E	6·28	...	3·2
a	8	29·382	·024	·077	·150	29·8	36·2	35·7	32·87	·154	·191	·190	·171	94	90	91	91	S E b E	E b S	W b N	6·53	0·465	...
b	9	·163	·140	·272	·199	31·6	21·4	30·9	28·55	·162	·097	·156	·138	92	81	91	87	W b S	W b S	W b N	8·30	...	0·2
d	10	·475	·743	·977	·761	18·3	19·3	7·9	15·07	·088	·081	·056	·076	85	75	83	82	W N W	N W	Calm	5·18	...	...
b	11	30·125	30·164	30·055	30·118	0·3	13·2	18·6	11·07	·045	·056	·092	·067	92	67	88	84	Calm	S E b E	E S E	5·27	...	Inap.
a	12	29·913	29·727	—	—	22·1	24·8	—	—	·108	·128	—	—	88	90	—	—	E S E	E	—	11·32	0·685	...
c	13	·433	·359	29·512	29·447	35·2	38·4	34·8	36·10	·203	·220	·185	·203	99	95	92	96	E	Calm	N N W	5·32	0·065	0·2
c	14	·677	·582	·259	·484	30·2	26·0	27·6	28·10	·158	·134	·135	.142	94	94	88	91	N E b N	E N E	E	9·69	Inap.	0·5
c	15	·274	·473	·593	·461	32·6	27·3	25·6	27·98	·179	·131	·125	·141	97	86	88	90	S S W	W	W S W	7·64	...	...
c	16	·684	·700	·847	·787	22·6	24·1	17·8	21·22	·112	·115	·085	·101	90	86	84	85	W b S	W b S	W N W	5·09	...	0·1
b	17	·974	·968	·819	·915	9·9	21·3	20·7	17·85	·060	·085	·100	·083	81	73	86	79	Calm	W b S	S W b W	7 32	...	...
b	18	·691	·435	·579	·568	24·9	39·1	29·4	31·28	·128	·197	·152	·161	89	83	94	90	S W b W	S W b W	N b W	8·87	...	0·2
b	19	·768	·836	—	—	16·2	23·6	—	—	·080	·098	—	—	84	75	—	—	N W b N	N b E	—	4·37	...	...
a	20	·715	·614	·559	·621	18·6	24·0	19·8	20·53	·088	·085	·094	·089	83	64	83	78	N E b E	E	N E b E	9·87	...	...
a	21	·625	·626	·576	·605	16·5	28·2	29·1	25·57	·087	·181	·129	·121	90.	84	80	85	N N E	S S W	S W b S	3·97	...	0·1
a	22	·436	·251	·564	·412	33·4	35·7	10·8	26·60	·174	·187	·072	·145	92	89	96	92	S W b W	S W	N N W	13·24	...	2·5
a	23	·976	·985	·872	·941	0·4	13·2	15·9	10·55	·044	·053	·080	·061	90	64	84	79	N N W	N W	W S W	6·65	...	...
e	24	·763	·776	30·018	·860	22·0	34·5	21·5	25·28	·107	·172	·106	·124	88	86	89	87	W	W N W	N N E	8·15	...	0·2
c	25	30·129	30·007	29·870	·997	14·4	16·2	22·4	17·70	·076	·081	·110	·090	86	86	88	87	E b S	E b S	E b N	11·83	0·105	1·0
c	26	29·574	29·148	—	—	32·9	32·3	—	—	·176	·176	—	—	95	96	—	—	E b S	E	—	12·07	0·140	5·5
ca	27	·676	30·001	30·161	.972	16·2	22·4	8·0	15·37	·085	·109	·059	·088	90	87	87	87	N b E	N	N b'E	7·48	...	...
a	28	30·121	29·967	29·908	·991	2·0	29·7	29·1	21·25	·042	·143	·142	·110	82	87	88	85	N b E	N W b W	S W b S	1·70	...	...
																		Miles.	Miles.	Miles.	Miles		
	M	29·697	29·669	29·710	29·695	17·39	25·00	20·91	21·09	0·102	0·118	0·108	0·110	89	83	86	86	6·51	7·08	7·17	6·91	1·460	18·0

Highest Barometer...... 30·172, at 8 a.m. on 11th } Monthly range:
Lowest Barometer ...... 29·002, at 4 p.m. on 8th } 1·170 inches.

Highest temperature.... 42°·8, at p.m. on 1st } Monthly range:
Lowest temperature..... –10°·8, at a.m. on 3rd } 53°·6.

Mean Maximum Thermometer.............. 29°·63 } Mean daily range:
Mean Minimum Thermometer.............. 9°·15 } 20°·47.

Greatest daily range............... 37°·1, from p.m. 22nd to a.m. of 23rd.

Warmest day........ 1st. Mean temperature...... 37°·12 } Difference,
Coldest day.......... 3rd. Mean temperature...... 4°·62 } 32°·50.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1743·79.	1577·85.	626·08.	1724·33.

Mean direction of Wind N 7° E.

Mean velocity of the Wind... 6·91 miles per hour.

Maximum velocity .... 22·9 miles per hour, from 9 to 10 p.m. on 22nd.

Most windy day...... 22nd; Mean velocity... 13·24 miles per hour.

Least windy day...... 6th; Mean velocity... 1.14 ditto.

Raining on 5 days. Raining 25·2 hours.

Snowing on 15 days. Snowing 60·8 hours.

Aurora observed on 4 days.

Possible to see Aurora on 12 days.

Impossible to see Aurora on 16 days.

The change of temperature from the 1st to the 2nd was very remarkable, amounting to 27°·64 between the mean of the two days.

Comparative Table for February.

Year.	Temperature.				Rain.		Snow.		Wind Mean Vel'y.	
	Mean.	Max. obs'vd.	Min. obs'vd.	Range.	D's.	Inch.	D'ys	Inch.		
	°	°	°	°						
1840	28·0	49·1	—8·3	57·4	8	1·475	6	Not Regis'd.	Not Regis'd.	
1841	22·4	43·4	—0·3	43·7	1	0·000	9			
1842	26·9	48·7	+2·5	46·2	8	3·625	9			
1843	14·5	37·5	—10·2	47·7	1	0·475	21	14·4	1·05	lb.
1844	26·0	47·1	—0·4	47·5	4	0·430	7	10·0	0·43	lb.
1845	26·0	46·6	—3·9	50·5	5	—	9	19·0	0·99	lb.
1846	20·4	41·4	—16·2	57·6	0	0·000	13	46·1	0·65	lb.
1847	21·5	42·2	—1·0	43·2	2	0·550	13	27·3	0·69	lb.
1848	26·6	46·9	—0·6	47·5	4	0·775	8	10·8	5·69	Miles.
1849	19·5	41·1	—9·2	50·3	2	0·240	13	19·2	6·58	Miles.
1850	26·0	49·2	+1·3	47·9	7	1·235	9	23·1	7·61	Miles.
1851	27·6	50·2	+1·3	48·9	7	2·600	4	2·4	6·94	Miles.
1852	23·4	41·2	—3·2	44·4	3	0·650	11	13·0	6·42	Miles.
1853	24·1	43·4	—0·6	44·0	4	1·030	15	12·6	7·29	Miles.
1854	21·1	42·7	—5·7	48·4	5	1·460	15	18·0	6·91	Miles.
									0·76	lb.
M'n.	23·60	44·71	— ·63	48·85	4·1	1·039	10.8	18·0	6·78	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—February, 1854.
NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 Feet.

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			6 A.M.	2 P.M.	10 P.M.
1	28·999	29·000	29·030	33·0	43·2	33·1	·197	·280	·191	·95	·94	·92	W b N	W b N	W S W	8·04	Calm	0·89		0·63	Str. 10.	Snow from 2 to	Str. 10.
2	29.305	·596	·489	19·0	21·2	18·0	117	086	099	91	58	82	N N E	E N E	N b E	Calm	10·12	2·28			Clear.	Str. 8. [6 p.m.	Do. 8.
3	·650	·596	·624	–16·1	7·8	–11·1	018	058	021	82	80	75	N N E	E N E	E b S	9·29	Calm	2·66			Do.	Clear.	Clear.
4	·796	·749	·764	–26·5	7·2	–12·0	009	058	021	70	82	75	W N W	E S E	S b W	0·26	Calm	0·87			Do.	Do.	Do. [at 5 p.m.
5	·810	·605	·657	–25·7	–3·7	–9·0	009	033	024	53	83	78	E	N E b E	N N E	Calm	4·20	7·92		Inapp	Do.	Do.	Str. 8. Snow
6	·821	·808	·836	–22·0	14·5	5·0	012	078	049	59	84	78	N N E	N W b W	W N W	1·90	Calm	3·19			Do.	Do.	Cir. Cum. 8.
7	·878	·807	·796	–11·2	15·0	6·5	021	089	059	75	89	92	W b N	N b W	N b E	0·22	Calm	0·82			Do.	Do.	Clear.
8	·561	·686	28·904	–3·1	12·2	18·5	051	090	113	94	94	93	N E b E	N E b E	N E b E	8·07	6·41	10·46		3·80	Snow.	Snow.	Snow.
9	28.960	29.010	29·023	17·5	38·2	30·0	096	217	160	83	80	86	N b W	N N W	N b W	5·02	1·92	15·32		0·10	Clear.	Slight Snow.	Cir. Str. 4.
10	29.174	·370	·622	20·1	14·5	5·0	107	087	049	82	80	78	W b N	N W b W	N W b W	15·87	16·25	12·19		Inapp	Cir. Str. 4.	Clear.	Clear A. Bo-
11	·760	·834	·854	–18·4	6·9	–6·0	014	052	030	66	79	81	N W b W	W	W b N	9·64	3·40	6·66			Clear.	Do.	Do. [realis.
12	·995	·867	·775	–22·5	6·5	0·5	015	043	042	88	63	84	W b N	N E b E	E N E	Calm	0·12	1·50			Do.	Do.	Cum. 8.
13	·538	·377	·366	8·5	31·2	32·7	065	164	198	93	94	96	N E b E	S b E	S S E	2·09	7·05	4·90	0·08	1.11	Snow at 7.30.	Cum. Str. 8.	Rain at 4.40 p.
14	·547	·534	·537	25·5	26·3	21·5	123	147	115	79	92	94	N b E	N E b N	N E b E	12·72	8·83	15·00	0·04		Rain.	Str. 10.	Str. 10. [m.
15	·260	·227	·331	22·3	33·2	27·0	120	187	146	95	90	88	E N E	N W	W S W	16·04	4·23	1·20	0·03	3·80	Snow.	Sleet.	Do. 10.
16	·401	·371	·462	22·1	22·5	14·0	115	108	088	82	77	83	W b S	W N W	W b N	7·62	9·07	10·37			Str. 10.	Cum. Cir. Str.	Clear Aurora
17	·575	·566	·553	11·0	20·0	14·0	077	083	091	83	63	87	W	W b N	W S W	11·70	9·31	9·33			Clear.	Clear. [6.	Do. [Borealis.
18	·408	·216	·308	20·0	31·0	28·7	107	178	161	82	92	89	S W b W	S W b W	W b S	8·14	12·85	6·28		Inapp	Str. 10.	Str. 10.	Str. 10.
19	·469	·665	·731	–4·0	10·0	–5·0	033	062	031	83	80	82	N b W	W b N	W b S	13·00	0·20	Calm			Clear.	Clear.	Clear. Zodiac.
20	·714	·673	·544	–16·9	10·0	–3·0	013	053	041	56	66	96	N E b N	N E b E	N E	Calm	0·02	1·68			Do.	Do.	Do. [Light.*
21	·456	·308	·392	–8·0	26·6	6·1	036	134	052	84	88	79	N E	S S E	S W b S	7·18	0·87	Calm			Do.	Light Cir. 4.	Do. Faint A.B
22	·278	·208	28·999	14·0	32·0	26·2	076	170	141	84	90	96	S E b S	N E	S b W	Calm	Calm	1·44		3·60	Str. 10.	Snow.	Snow c'd 11.40
23	·487	·579	29·645	–7·0	1·2	–6·0	028	040	036	80	75	90	W N W	W N W	W	14·70	15·00	6·82		0·82	Clear.	Clear.	Clear.† [p.m.
24	·609	·557	·757	–2·0	19·1	3·6	051	086	045	92	87	77	W	W	W	0·29	0·18	2·17		Inapp	Str. 10.	Do.	Do. Aur. Bo.‡
25	30·001	30·072	·969	–16·3	–0·7	–5·2	013	027	040	56	53	90	N E	N E b E	N E b E	1·75	0·08	15·14			Clear.	Do.	Str. 4. [night.
26	29·696	29·461	·044	6·8	15·0	20·5	059	081	110	92	84	90	N E b E	N E b E	N E b E	3·23	2·50	25·50		8·90	Str. 4.	Snow com. at	Snow c'd mid-
27	·462	·611	·659	13·2	34·5	7·2	074	186	054	83	87	79	N b E	N W b W	N W b W	19·00	0·23	0·37		1·20	Clear.	Clear. [10 a.m	Clear Aurora
28	·749	·654	·655	–8·8	34·3	13·1	026	178	088	76	83	87	N W	S W b S	S S W	Calm	Calm	Calm			Do.	Do.	Do. [Borealis.

Barometer	Highest, the 25th day	30·072
	Lowest, the 8th day	28·904
	Monthly Mean	29·620
	" Range	1·168
Thermometer.	Highest, the 1st day	44°·0
	Lowest, the 5th day	–27°·7
	Monthly Mean	12°·20
	" Range	71°·7
	Mean Humidity	·825
Greatest Intensity of the Sun's Rays		128°·0

The Mean Temperature of the Month was 4°·16 below that of last year.
Rain fell on 3 days amounting to 0·15 inches.
Snow fell on 13 days amounting to 23·96 inches.
Most prevalent Wind, N E b E. Least do., do., E.
Most Windy Day, the 10th day; mean miles per hour, 14·77.
Least Windy Day, the 28th day; mean miles per hour, 0·00.
Zodiacal Light was very bright during the month.
Aurora Borealis visible on 5 nights. Might have been seen on 10 nights.
The electrical state of the atmosphere has been marked *generally* by moderate intensity, and during the storms of the 22nd and 26th days indicated a very high tension of negative electricity.

* 19th and 20th. Very bright and well defined. † 23rd. Zodiacal Light bright. ‡ 24th. Very splendid.

Monthly Meteorological Register, Quebec, Canada East.—February, 1854.

BY LIEUT. A. NOBLE, R.A.

Latitude, 46 *deg.* 49·2 *min. North; Longitude*, 71 *deg.* 16 *min. West. Elevation above the level of the Sea,* — *Feet.*

Date.	Barometer corrected and reduced to 32 degrees, Fahr.				Temperature of Air.				Elasticity of Air.				Humidity of Air.				Direction of Wind.			Velocity of Miles.			Rain in inch.	Snow in inch.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.		
					°	°	°	°																
1	29·198	29·171	29·272	29·212	25·5	86·0	84·6	82·0	·124	·158	·176	·151	88	73	89	88	N W	N W	N W	8·8	8·0	7·2	...	0·2
2	·404	·582	·697	·561	15·4	12·5	5·7	11·2	066	068	046	060	71	80	76	76	N W	W	E	11·8	10·1	8·0	...	...
3	·875	·882	·958	·903	–4·6	4·5	–6·8	–2·1	027	045	028	082	71	77	63	70	E	E	E	8·0	8·8	8·0	...	...
4	·979	30·011	30·114	30·085	–21·8	–1·5	–9·4	–10·9	010	085	018	021	59	76	57	64	W N W	W N W	W N W	9·4	8·8	8·0	...	...
5	30·091	29·987	·068	·048	–28·0	0·0	–19·5	–14·2	008	080	000	018	48	63	00	87	W	Calm	Calm	3·8	...	...	...	...
6	·086	80·104	·175	·122	–11·6	–2·0	–7·5	–7·0	020	028	024	024	70	65	69	68	N N W	N b W	W b N	3·8	8·0	8·0	...	...
7	·179	·200	·165	·181	–16·7	+7·5	–9·8	–6·8	012	048	028	029	55	64	77	65	W	W b N	W	8·0	6·2	8·8	...	...
8	·101	29·818	29·841	29·751	–10·4	12·0	15·6	5·7	018	060	072	050	59	75	77	70	E	E	E	11·8	19·7	11·8	...	6·0
9	29·168	·205	·254	·209	18·8	28·0	29·4	25·2	079	188	141	119	76	89	87	84	E	E	E	10·1	8·0	8·0	...	1·0
10	·838	·469	·818	·588	20·6	27·4	8·4	17·1	092	121	044	089	81	80	78	80	W b S	W b N	W b N	7·2	6·2	6·2	...	...
11	80·052	30·088	30·222	30·119	–15·6	2·4	–6·0	–6·4	014	042	028	026	62	80	68	68	W	W	W	6·2	7·2	8·0	...	...
12	·250	·262	·247	·258	–16·2	6·5	–4·0	–4·6	009	045	026	027	42	70	65	59	W	E b S	E	8·0	8·0	13·4	...	...
13	·096	29·962	29·824	29·961	8·2	15·0	22·0	15·0	059	078	106	081	87	85	87	86	E	E	E	22·7	32·1	82·1	...	6·0
14	29·855	·963	30·005	·941	24·5	26·5	21·5	24·2	117	126	098	080	87	86	81	85	E	E	E	34·1	39·4	84·1	...	2·0
15	·866	·729	29·626	·740	22·5	24·5	26·6	24·5	101	117	184	117	81	87	95	88	E	E	E	27·8	16·0	11·8	...	5·0
16	·652	·608	·675	·645	22·5	80·0	15·5	22·6	101	150	072	108	81	90	77	88	N W	N W	W N W	10·1	18·9	10·9	...	0·2
17	·820	·810	·825	·818	10·5	23·4	18·5	15·8	077	114	071	087	55	88	82	75	N	W	W	8·8	10·1	10·9	...	...
18	·698	·518	·478	·568	15·4	81·0	25·5	28·9	076	150	119	115	88	85	85	84	N	W	W	18·8	19·5	16·0	...	8·0
19	·900	·947	80·066	·971	–8·6	8·8	–7·0	–4·1	022	089	024	028	67	71	67	68	W	W	W	10·9	8·0	7·2	...	...
20	80·116	80·051	29·988	30·050	–16·5	9·5	–1·8	–2·9	012	059	084	035	55	81	75	70	W	N W	Calm	8·0	8·8	...	...	...
21	29·882	29·781	·777	29·818	–8·0	17·0	8·8	4·1	022	075	046	048	66	77	82	75	E	E N E	E N E	8 8	9·4	8·0	...	...
22	·674	·488	·868	·492	5·0	26·0	21·5	17·5	047	128	098	091	79	88	81	88	E N E	E N E	E N E	8·0	8·0	8·0	...	5·5
23	·445	·616	·866	·642	14·0	18·0	–1·5	10·2	074	089	086	066	84	87	81	84	E N E	N W	N W	11·8	11·5	11·8	...	...
24	·854	·857	·962	·891	–8·6	9·5	–2·5	–0·5	021	057	025	034	65	79	56	67	W	W N W	W N W	10·1	9·4	8·8	...	...
25	80·891	80·496	80·468	80·451	–20·8	0·0	–8·0	–9·6	012	085	022	028	61	76	66	68	W b N	W b N	W b N	10·1	8·0	8·8	...	...
26	·252	29·974	29·401	29·876	4·0	18·5	24·4	15·6	045	086	121	084	79	82	91	84	E S E	E b S	E b S	8·0	7·2	10·9	...	14·0
27	29·522	·868	80·176	·854	17·6	28·7	11·5	17·6	094	098	058	088	92	75	75	81	W b S	W b N	W b N	10·9	18·9	6·2	...	...
28	80·880	80·194	·000	80·175	1·0	24·0	14·5	18·2	021	108	075	068	51	82	85	78	W b N	W	W	7·2	8·8	9·4	...	1·0
M	29·859	29·834	29·850	29·850	1·5	16·4	7·8	8·1	·049	·088	·068	·065	70	79	74	74				10·8	11·3	10·2		48·9

REMARKS.

5th. River St. Lawrence froze across opposite Quebec. The ice was, however, swept away by the tide.

6th. The St. Lawrence again frozen across, and the ice-bridge remained.

28th. Brilliant Aurora at 12. The whole of the northern horizon was of a pale, violet colour, and there was one patch of streamers in the N.E.

Highest Barometer, at 2 p.m. on the 25th .... 30·496 } Monthly Range, 1·325 in.
Lowest Barometer, at 2 p.m. on the 1st.................. 29·171 }

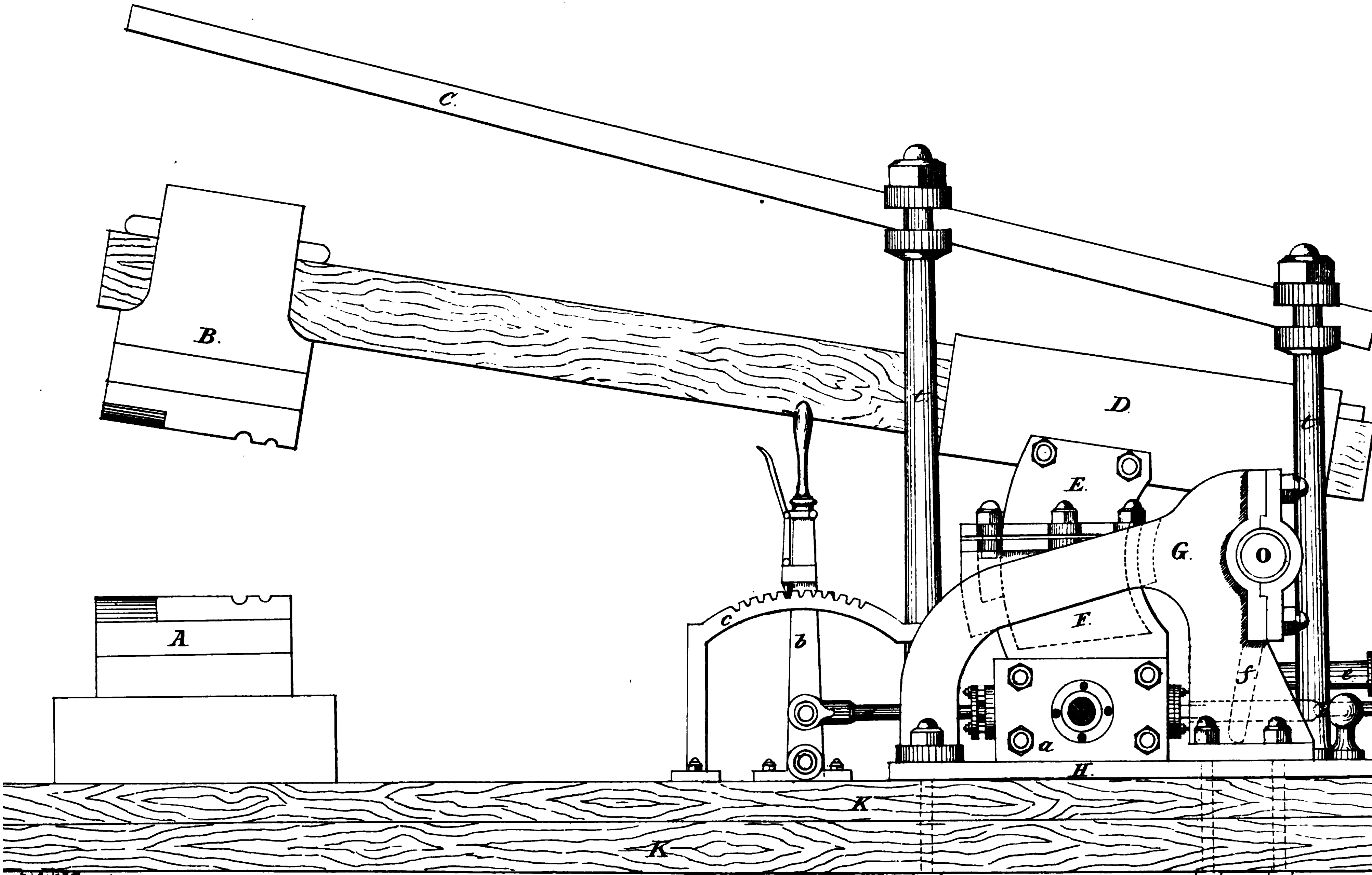
Maximum Thermometer, on the 1st .... 36°·0 } Monthly Range, 60°·0
Minimum Thermometer, on the 5th......................... -24°·0 }

Mean Maximum Thermometer .... 17°·0 } Mean Daily Range, 22°·4
Mean Minimum Thermometer................................ -5°·4 }

Greatest Daily Range, on the 10th...... .... 43°·1
Least Daily Range, on the 15th.. .... 4°·0

Warmest Day, the 1st; mean temperature............. 32°·0 } Climatic Difference, 46°·2
Coldest Day, the 5th; mean temperature............... -14°·2 }

Possible to see Aurora on 13 nights.
Aurora visible on 9 nights.



SYKES' STEAM HAMMER.

The Canadian Journal.

TORONTO, MAY, 1854.

Memoranda of Vesuvius and its Neighbourhood.

By the Rev. Henry Scadding, D.D., Cantab. Read before the Canadian Institute, March 25th, 1854.

Those who have visited Saratoga will perhaps remember the High-Rock Spring. It has its name from the circumstance that its water, containing much lime in solution, has formed a mound of calcareous matter some five feet high, with a well-defined central throat, up which the fluid column in former times ascended. This conical hillock must have had its beginning from the water in the first instance rising with force through the surface of the soil, and depositing a sheet of calcareous matter. The same process going on from year to year, minute strata accumulated, until the present altitude of the mound was attained. The falling of a tree then caused a fracture in the mass, since which occurrence the water, instead of flowing over the top, has found a lateral outlet.

We compare indeed small things with great, and slight with enormous energy; but the High-Rock Spring may serve to illustrate the manner in which volcanic hills are formed. An aperture is found, in a fissure we will suppose, in the crust of the earth; fluid matter is forced up from below, and, as it spreads itself out around the orifice from which it issues, it becomes solid: another ejection takes place: another thickness swells the dimensions of the growing mound: the process is repeated, until, in a succession of years, or in some instances in a few hours, a mountain is accumulated. A central channel is preserved, up which fresh matter still ascends, except when the energy below diminishes or a side-vent is opened.

All the mountain chains upon the globe, indeed, were probably thrown up by the force which we still see active in volcanoes. But with the majority of mountain chains there does not appear to have been any explosion. The elastic gases have lifted the superincumbent strata without forcing for themselves a passage. In many regions of the globe, semi-fluid granite just protruded itself through long fissures in the overlying deposits, and became *set*—a ponderous ocean at the time, in some localities at least—tending to depress and perhaps cool the uprising mass.

The mountains which we call volcanoes have, especially in regard to their upper portion and cone, grown by the accretion of ejected volcanic substances. In some volcanoes these ejections continue to take place from the original orifice or crater; in others, the interior force has become diminished, so as to be capable of thrusting the molten fluid only up to a certain point, where it continues in a state of ebullition either visible to the eye, or concealed by a crust of solidified lava; in others, lateral openings are formed at points below the ancient crater; and in others, the volcanic energy seems to have worn itself out.

Of the last class are the extinct volcanoes of Auvergne and Velay in France, of Catalonia in Spain, of the Eifel district in Germany:—of the next to the last are Ætna, the Peak of Teneriffe, and Cotopaxi:—of the next preceding, Kirauea in Hawaii is an example:—and of the first mentioned numerous class, Vesuvius, the mountain in respect to which I am about to offer a few memoranda, is a type.

Vesuvius, as compared with other active volcanic mountains, takes a low place, being only 3947 feet in height, while Antisana, in South America, the highest active volcano on the globe, is 19,137 feet high.

But although Vesuvius is one of the humblest of volcanic mountains, it has from many circumstances received peculiar attention. It is conveniently accessible to European observers. It is situated in the midst of a region rich in associations mythic and historic, unrivalled for physical beauty, and altogether strongly attractive to every imaginative and thoughtful person who has it in his power to visit foreign lands.

It is a memorable moment when, on waking in the morning and finding the steamer in which you have been travelling still and at anchor, you are told that you are in the Bay of Naples. You hasten to the deck. You take an excited survey of the widely-sweeping panorama which overwhelms the eager eye. Ships in crowds are near you, and craft with the obliquely-set latine yard-arms. Boats are moving silently on the surface of the iridescent water, which is giving back from the eastern heavens the kindling glories of the rising sun. Sailors are rowing ashore: you hear the regular creak of the row-locks as they work their oars, contrary to custom, with their faces towards the bow. Fishermen are paying out their long nets, hand over hand, indulging at the same time in a low chant-like song. In front of you, terrace rises above terrace of cheerful habitations, crowned with monastic edifices and massive fortifications. Behind you are castles and encircling moles —one bearing a colossal figure with hand upraised to bless (St. Januarius)—another sustaining a lanterna or pharos-tower, whose light still gleams down towards you along the surface of the water, though the day comes on apace. To add to the excitement of the scene—drawing again on the incidents of a morning indelibly impressed on my own recollection—a royal salute is fulminated from the castle on the left, which is no sooner ended, than responsively from another in the far distance on the right, a similar series of explosions takes place, each detonation following late after the quick scintillation of the flash, making the deck on which you stand to shake, and reverberating finely among the hills. Be it understood that the King has had an additional Prince born within the palace which you see yonder near the shore, and a festival of sixteen days has been proclaimed—sixteen days which, every morn and every eve, are to be signalized by similar stunning demonstrations, by illuminations also, and reviews and music, and whatever else may constitute a Neapolitan holiday.

But of all the objects which attract the attention as you gaze around the grand panorama before you, two mountains, side by side, close upon the right, isolated, of purple hue, and well-defined from base to summit, rivet at last the eye. On the morning already referred to, the glow of daybreak had outspread itself immediately behind them. The planet Venus was splendidly conspicuous vertically over them, looking as if she had been a meteor, shot up and and held suspended at the culminating point. And there she remained beautifully visible for a considerable time after the surrounding constellations had "paled their ineffectual fires" before the ascending sun. Over the easternmost of the two mountains rested what appeared at the moment to be a dark cloud, varying considerably in form, looking in shade quite black in parts, and occasionally rolling up pitchy volumes, like the smoke issuing from the great funnel of an Atlantic steam-ship when fresh coal is being put on below, the whole mass becoming at last magnificently fringed with fiery gold, as the sun gradually emerged from behind it and pierced its murky folds. These twin-mountains together form Vesuvius.

I observe in the ancient, so-called classic maps, that the name

attached to the basin which we call the Bay of Naples is "Crater." The old observers had taken notice that there was in this locality a connected system of volcanic vents, and that Vesuvius, Volture, the Solfatara of the Phlegræan fields, Avernus, Ischia, Stromboli, with Ætna itself, were but minor formations on the lip of a gigantic flue for the escape of the elastic gases, whose egress by their former channel the influx of the Mediterranean had checked. In that old appellation—"Crater"—have we not also a lingering reminiscence of a huge upheaval, and consequent oscillation of ocean, of which tradition spoke—when perhaps the Aral parted company with the Caspian, and the Caspian with the Black Sea, and all three with the Baltic,—when the Black Sea no longer formed a continuous expanse with the Mediterranean,—when Thessaly became dry land, and Pelion fell from Ossa,—when the Red Sea ceased to receive the Jordan, and the valley of the Nile, the Mediterranean,—when the mountain chain which had previously linked the continents of Europe and Africa together was ruptured, and Atlantis, not all a fable, sank beneath the deep?

But be this as it may, Vesuvius is one of a system of volcanic vents, either open or for the present obstructed, which it is interesting to trace in this neighbourhood;—with which system are doubtless connected also the extinct volcanoes of the Albano hills, near Rome, the Solfatara on the road to Tivoli, and the Lago di Bracciano, to the north-west of Rome.

The base of Vesuvius is now encompassed on two sides by railways. The one to the north-east runs to Capua, and is ultimately to reach Rome. The other to the south-east is completed, I believe, now to the ancient port of Brundisium. The south-eastern road has "stations" at Herculaneum and Pompeii, and by this route many persons proceed from Naples to Resina, where the ascent of Vesuvius is usually commenced. But although to travellers in the United States of America the idea of rushing by rail to Rome, Syracuse, and Troy is sufficiently familiar, the tourist who is desirous of keeping his mind in harmony with the past, whose veritable relics he is about to contemplate, will certainly do well to prefer the old public road. By taking this route to Pompeii, you also have the advantage of witnessing a succession of animated scenes of popular life, the whole line of road being an almost continuous suburb of Naples, and swarming with inhabitants. Here will be seen crowds, who, in their sun-burnt, copper-coloured skins, scantiness of dress, showiness of rude ornament, and want of productive occupation, will strike the Canadian who has visited Caughnawaga, Manitouahning, or the Sault, as—Indians, of a rather superior class. In your way out, too, by this route, you will be sure to meet or pass numbers of those nondescript, characteristic vehicles of the neighbourhood, the country caleches, made so brilliant with gay paint and bright brass, in respect to which one is constrained to wonder (first) how fourteen or more passengers—embracing motley groups of peasants, soldiers, ecclesiastics, monks, women, children, and infants in arms—can be placed within them, or slung on to them—for slung on many literally are in nets hanging down behind,—and (secondly) how the one diminutive horse or mule manages to whirl them along as, decked with little flags, streaming ribands, jingling bells, and glittering gear, he merrily does. You will have an opportunity of calling, if you feel inclined to do so, at one of the innumerable maccaroni manufactories which—at Torre del Annunciata, for example—line the street, where almost every house looks like a chandlery of farthing rushlights, the pipes of the popular esculent suspended in the open air on countless rows of long rods to dry, resembling in colour and diameter that once celebrated article. Within, you can examine the process, which will not fail to interest, by which the farinaceous dough of which this staple food of the neighbourhood consists is forced into the various shapes of maccaroni, vermicelli, fedelini, ribands, sheets, and the minute little discs resembling the green seeds of the hollyhock, so abundantly to be met with in Neapolitan soups.

At Torre del Greco you can descend from your carriage and examine the lava, which here in vast sheets has found at various times its way into the sea. In 1794 it destroyed the principal portion of this town by passing through it in a stream 1200 feet wide, and of a thickness varying from 12 to 40 feet, advancing into the Mediterranean a distance of 380 feet. The desolation occasioned by this, and another later fiery flood (1806), is still fresh to the eye. The disintegrating force of the atmosphere has not yet had time to dissolve the rocky surface into soil, which ultimately heals the wounds of earth, and obliterates all scars. The colour of the solid mass is here a dark bluish gray, reminding one of our familiar Kingston limestone when newly quarried. Here, and everywhere along the drive out from Naples, the lava is seen turned to useful account. Houses are built of it; the streets are paved with it; the heaps of metal piled by the way-side for the purpose of repair are composed of the same omnipresent substance.

But in noticing what may be seen at Torre del Annunciata and Torre del Greco I have gone beyond Resina, where, as I have said, the ascent of Vesuvius is usually commenced. In practice, indeed, I believe, persons generally do pass through Resina, visiting Pompeii first, and taking Vesuvius in their return. But inasmuch as "Vesuvius and its neighbourhood" is my subject, I hasten to despatch the mountain first, and reserve what I have to say on its neighbourhood for the second division of my paper.

Deposited, then, at Resina, you procure horses and a guide. An unromantic carriage-drive has been constructed, by which a considerable portion of the mountain may be circuitously ascended. A more interesting mode of ascent is by a rough bridle-path on horseback. Taking this route, you proceed up a sort of water-course, passing over bare lava which shelves backwards by great flights of broad irregular steps. At first on the right and left are vineyards and gardens, till you approach a rather level portion of the mountain, where stand the place of refreshment called the Hermitage and an Astronomical Observatory —not the scene of the discoveries of De Gasparis—*that*, one gazes at with interest close to Naples itself. At this point vegetation ceases, or has been destroyed over the upper portions of the southern and western flanks of the mountain, and the far outskirts of the cone begin to present some rather startling evidences of the desolating power of volcanoes. The whole apex of the mountain rises solemnly before you, apparently a pile of solid lava—of lava which bears very visible marks of having flowed down from the crater above in broad outspreading cataracts. Its furrowed, rutty look is like the surface of one of our unmacadamized back-streets after a sudden frost. Here and there you see where the descending ponderous fluid has met in its course with some solid mass of anterior date, and has coiled heavily around it, leaving great sluggish circular ripples, set fast for ever. You start from Resina very buoyantly; you are carried gaily along on your willing nag. The brilliancy of earth, air, and sky fills the mind with a sort of child-like glee. But as you approach the base of the cone, a sobriety comes over the spirit. Like the child advanced onwards into manhood, you find that you have entered a rather stern region, and that nothing short of hard work will enable you to overcome its difficulties.

Arrived at length, after two hours and a half, at the Atrio del Cavallo, near the base of the cone, you dismount. You take a rough scramble up a wild desolate ravine underneath the precipitous walls of Monte Somma, the north-westerly summit of Vesuvius; you notice the stratified layers of the ancient lava, and the

buttress-like dykes of subsequent and apparently harder lava jutting out from the semi-circular escarpment of this, the original gigantic crater of the volcano of the pre-historic times; and after satisfying your curiosity as well as the time will admit, you return and begin the ascent of the cone.

The place chosen for this exploit is a part built up, so to speak, with closely-packed fragments of lava and slag, between the interstices and among the prominences of which you insert your feet, to the certain disruption of only moderately strong shoes. The whole inclination of Vesuvius, were it uniform from Resina to the lip of the crater, would be only about thirteen degrees. Up to the base of the cone it is still less; but the cone itself is inclined at an angle of forty-three degrees. The perpendicular height of the cone is about 1000 feet; so that it can easily be conceived that the physical labour of ascending it—to a person not accustomed to climb—is for the time extremely painful. It requires, indeed, many "corragios" from the guide, and some assistance from a looped strap which he throws over his shoulder for you to lay hold of, to enable you to persevere.

While toiling thus sorely up this steep, I began to be convinced that the good Franks of yore really did mean by their word "travail" what some etymologists have asserted. To get "trans vallum"—beyond the wall—to scale the precipitous flank of some old Roman camp, was doubtless to their warriors some such task as this—a difficulty memorable enough, certainly, to be embodied in a term.

At length, after numerous rests, and after a lapse of perhaps an hour and a half, you find yourself on the comparatively level platform which leads to the lip of the great crater. The desire accomplished is found to be truly sweet on such an occasion, and the propensity to be noisily elated is quite overpowering. A strong wind blowing in our direction, sweeping down over us a huge column of vapour, which completely obstructs the vision, obliges us several times still to halt in our ascent of the final gently inclined plane.

At last we are on the brink of the great crater, and we find ourselves looking down into a gigantic and tolerably sooty-looking flue, up which from unknown mysterious depths are rolling volumes of what in the distance seems smoke, but which is, in fact, steam —steam carrying up with it a variety of choking gases. The whole breathing apparatus becomes immediately painfully affected, and we are reminded of the sensation suddenly experienced when one passes the nostrils over the edge of some great vat where fermentation is going on. The reverberation of a shout directed by the guide or yourself down into the undefined abyss is sufficiently awe-inspiring. Its effect can in some degree be conceived by imagining how a shout would sound when directed into a hollow cask one thousand feet in diameter.

The view obtained in every direction from this position is in the highest degree interesting and exciting. The Appenines form the background of the picture, a congeries of secondary and tertiary formations, exhibiting in their retiring ranges phase after phase of the finest aerial colouring. On one side you look down upon a city, pre-eminently of the living, ever on the stir and outwardly joyous—the syren-city, a sight of which its inhabitants fondly say might reconcile a man to the relinquishment of life. On another side, in solemn and instructive contrast, you see cities of the dead —historic fossil beds—mines not yet exhausted by the student and philosopher. Around you, on the left and right, are Capri, Ischia, Procida, Miseno, Baiæ, names summoning up images of beauty and long trains of shadowy forms and events. Yonder is Posilipo, the "grief-dispelling," the favourite haunt of the poet who, before the Christian era, sang the praises of this region, and whose tomb now consecrates that height. Before you, far and wide, lies the tideless sea, a household word throughout the world, whose name recalls the ideas with which the old cosmographers vainly tried to satisfy inquiring minds—whose serene surface, stretching to the distant south and west, still now as of yore reflects and sets off to best advantage the never tiring, because sublime pageantry attendant on the demise of each successive day.

After traversing a portion of the rim of the great crater,—its whole circumference is 5624 feet,—holding firmly the arm of the experienced guide, you begin to clamber obliquely down into the interior of the orifice. Your feet sink deep in black pulverized lava or sand. You observe underneath the surface everywhere beautiful primrose-coloured sulphur, perpetually deposited here, I am informed, from the constantly ascending hydro-sulphuric acid gas. You observe the stratification of the successive accumulations on the cone. Everything is sensibly hot to the touch. At the direction of your conductor, you thrust your hand into various holes and crevices, and you are fain to draw it out again as quickly as possible—the heat either remaining from the eruption of 1850, or maintained by the continual ascent of hot vapour from below.

After descending some yards, what with the increasing gloom, the oppressive heat, the obscurity of the undefined depth on the left, the boisterous rush of air every now and then from above, blinding and choking you with steam, the adventure seems—to a novice at least—to be sufficiently beset with terrors; and one is not sorry when it is at last determined to re-ascend without actually setting foot on the floor of the crater, one hundred and fifty feet below.

The place chosen for the descent of the cone is wholly diverse from that just now described in my account of its ascent. Conceive one of those great earth-works which in so many directions are now advancing across our Canadian valleys for railway purposes. Imagine the perpendicular height of the part where the labourers are shooting down load after load of loose soil to be one thousand feet, and the inclination of the slope to be precisely the angle at which the material will remain at rest:—you have then an idea of the part of the cone where tourists go down from the summit of Vesuvius. This side is of course selected from its being composed, not of closely-packed masses of slag and lava, but of pulverized volcanic matter.

Linking yourself firmly to your guides' arm, you plunge fearlessly off. You take strides which seem miraculous. The material in which you plant your heels goes down along with you and after you. You have only to take care that nothing arrests the action of your feet;—any obstruction might send you centrifugally forwards. Everything being in your favour, you are of course at the bottom in an incredibly short space of time. I remarked just now on the never-to-be-forgotten painful exhaustion produced in the ascent of this cone: its descent is equally memorable for the exhilarating and quickening effect which it has on personages even of the gravest carriage.

At the foot of the cone the patient ponies are waiting. After satisfying a number of noisy applicants who claim to have rendered you service, you mount, and, accompanied by men carrying torches—for it is now dark night—you amble gently down to Resina. From thence you drive into Naples. Your mind throughout the day has been receiving impressions which are to endure for life, and it has become in an extraordinary degree excited. You feel and welcome the calming influence of the quiet stars that burn above you, and which recall the kindred splendours of your own far-distant skies.

The first recorded eruption of Vesuvius is that of A.D. 79, when Herculaneum, Pompeii, and Stabiæ were overwhelmed. It is supposed that by this explosion the upper portion of the mountain was considerably reduced in its dimensions. Strabo, the geographer, about the year A.D. 25, describes it as a truncated cone covered with vegetation nearly to its summit. Its configuration, as it then presented itself to the eye from Naples, can easily be imagined by supposing the circle of which Monte Somma is a segment to be continued all round, and the line of the present inclination of the mountain on the south-east side to be produced from the slight rise called Pedamentina until it meets this circle, the axis of the whole cone remaining the same as it is now. The portion which we thus in imagination supply, is supposed to have been broken down by the weight of the lava which accumulated in the crater after the re-awakening of the volcano in A.D. 79.

The north-eastern side of Somma is to this day a smiling slope of vineyards, gardens, farm-houses, and villages. In the days of Strabo, the south-western slopes presented a similar scene. The poet Virgil, who, as I have already said, was familiar with this Campanian coast, and has celebrated in his verse its most striking localities, does not fail to notice Vesuvius; but he does not give us to understand that he was aware of its volcanic character. From Strabo, however, we learn that it was known to be volcanic. Plutarch, in his life of Crassus, mentions a curious use to which the crater in its quiescent state was once put. Spartacus, the Gladiator, who, in B.C. 73, headed a formidable insurrection against the Roman government, entrenched himself here with his forces, after his defeat by Crassus. The swordsman had doubtless defended himself in many an arena before, but in none on so grand a scale as this. Beseiged by the prætor Clodius, who thought it simply sufficient to watch the entrance to the crater—the ravine to which I have already referred as existing between Somma and the present cone—Spartacus and his men let themselves down over the precipices by means of the wild vines which grew there, and suddenly and successfully attacked their assailants in the rear.

The poet Martial, who saw the mountain a few years after the desolating eruption of A.D. 79, records the lamentable change which had taken place in its appearance. "These heights," he says, "Bacchus loved more than his own Nysa; here the rustic Satyrs held their dances; Venus preferred the spot to Lacedæmon; here Hercules himself had sojourned; but now everything lies prostrate beneath fiery floods and melancholy scoriæ."

It may be here stated that the name Vesuvius—which by Roman writers is variously written Vesevus, Vesvius, Vesbius—is said by Neapolitan scholars to have been given to the mountain by the Phœnicians, who, at periods prior to the old Greek foretime, formed settlements along the Italian coasts. Its Syriac form was *Vo-seveev*, "the place of flame." Similarly, *Herculaneum* has been derived from *Horoh-kalie*, "pregnant with fire;" *Pompeii* from *Pum-peeah*, "the mouth of a furnace;" and *Stabiæ* from *Seteph*, "overflow."

In the remarks which I now offer on Pompeii, I simply speak of the place as one of the accessories of Vesuvius. To do justice to Pompeii, in an archæological point of view, would require a separate paper. It is well known that this city was not overwhelmed with molten lava, but by showers of sand, ashes, scoriæ, and mud. The persons who lost their lives on the occasion, when compared with the population, were few. The great majority had time to make their escape. To those who first carefully examined the mass as it lay upon the various houses, it was manifest that there had been disturbances in its parts, showing that, after the catastrophe, some of the inhabitants returned to recover their effects. The exterior walls of the town, with their gateways and low turrets, are finely disclosed. Towards their base very ancient work is occasionally seen—resembling, in the arrangement of the ponderous irregular masses, the so-called Pelasgic style. In their upper portions a curious mixture of material occurs—of stone with brick-work, carefully stuccoed to resemble stone. Blocks are observed with inscriptions in Oscan—the words and letters appearing reversed, after the manner of types set up. To a Canadian, who is generally too well acquainted with "burnt districts," the interior of Pompeii has at the first glance the familiar look of a town recently devastated by fire. Bare roofless walls of no great altitude are standing about in all directions. Forests of pillars, perfect and imperfect, supply, in some quarters, the place of the chimneys, which, isolated or in stacks, are with us so conspicuous after a conflagration. The ruins, however, do not look black and fire-scathen. The compact pavement of the streets is composed of blocks of ancient lava of irregular shapes, laid together after the manner of the old Viæ, resembling somewhat, on the surface at least, the memorable flagging which formed our first attempt at trottoir-making in Toronto. Along the top of some of the walls, rows of modern tiles have been placed for protection by the Neapolitan Government. Upon the exterior of the walls along the streets you see inscriptions laid on with a sort of red paint—the names of the owners of the houses or of persons whom the owners desired to honour as patrons. Upon the walls of the Basilica—or Court-house, as we should say—idle persons, standing about, have scratched their autographs. I have taken down one—that of *C. Pumidius Dipilus*, who, more than eighteen centuries ago, thought it worth while thus publicly to record the fact that "he was here on the 7th day of October, B.C. 77," as we should now write the date. "C. Pumidius Dipilus, heic fuit ad nonas Octobreis, M. Lepid., Q. Catul. Cos." The little stones which compose the mosaics on the floors of the larger houses—exhibiting the originals of many of our oil-cloth and carpet patterns—are lava cut up into small blocks. The ancient frescoes on the interior walls—the prototypes of several styles of modern room-paper—are now much faded, though their designs are still clear. Whenever any objects of art and domestic use are unearthed in the excavations which are still occasionally made, they are deposited for safety in the Museo Borbonico in Naples. This museum, which is one of the most interesting in Europe, ought to be well studied by those who desire to have a clear idea of the ancient Græco-Italian life. Here you see a thousand things in the shape of utensil and ornament, personal and domestic, which show that the old Campanians were men like ourselves, influenced by the same tastes, wants, and weaknesses. Among innumerable objects of interest, I remember a charred loaf of bread—baked, of course, nearly eighteen centuries ago—bearing the baker's name (Cranius) legibly stamped upon it.

Thirteen years before the final catastrophe, we learn from Tacitus that the luxurious repose of Pompeii had been disturbed by a terrible earthquake. At the time of the last disaster, the inhabitants had just regained confidence to set about the repairs which had been rendered necessary. It is curious to observe in several quarters the partially new work. In the Forum, for example—the Public Exchange of the city—new lengths in the shafts of the fluted columns, resting on more ancient bases, are to be seen. On the ground are lying portions of columns nearly ready to be put up. Here stone-cutters' tools were found scattered about, as they had been left by their owners. Pillars in Pompeii, however, are not everywhere of stone; many are of brick, stuccoed Indeed I was rather surprised to find in Rome, as well as here, how largely brick and stucco enter into the material of ancient

buildings. Pompeii was situated at the mouth of the Sarnus; and most of the streets which have been uncovered, ran down to the edge of the sea westward from the entrance of the river. But the accumulations of volcanic substances have thrust off both the river and the sea—the former half a mile, the latter two miles, from their ancient places. Up every street, as you look towards the north-west, Vesuvius closes the vista—still showing, by his ever restless column of steam, how capable he is of again rousing up his destructive energies. About two-thirds of the city still remain unexcavated. Where the excavations cease, you can approach and examine the perpendicular sections of the whole mass of accumulated material. You observe immediately that numerous showers of volcanic matter have descended since A.D. 79.

Near the Amphitheatre, the different strata with their thicknesses may be traced as follows, beginning with the surface:—(1) Black sparkling sand (recent), 3 inches; (2) Vegetable mould, 3 feet; (3) Brown incoherent tuff, 1 foot 6 inches; (4) Small scoriæ and white lapilli, 3 inches; (5) Brown earthy tuff, 9 inches; (6) Brown earthy tuff, with lapilli, 4 feet; (7) Layer of whitish lapilli, 1 inch; (8) Grey solid tuff, 3 inches; (9) Pumice and white lapilli, 3 inches:—in all, 10 feet 4 inches (Lyell). Another observation, where the thickness is 20 feet, gives the arrangement of the strata as follows, beginning from below:—Separating the whole into five parts—the first three consist of pumice-stone in small pieces, resembling a light white cinder, and covering the pavement to the depth of 12 feet: the next portion, composed of six parts, begins with a stratum of small black stones, 3 inches in thickness; to this succeeds a thin layer of dry mud; upon this lies another stratum of little stones, of a mixed hue, in which blue predominates; then comes a second stratum of mud, separated from a third by a thin wavy line of mixed blue stones: this completes the fourth portion; while the fifth or highest division consists entirely of vegetable earth or decomposed volcanic matter (Gell). In the neighbourhood of Pompeii you see large fields of the cotton-plant, which about here reaches its northern limit in Europe. On leaving the inn near the ruined city, I was taken by surprise by being presented with a bouquet of bursting cotton-pods and flowers, accompanied by a salute upon the hand—the graceful offerings of a handsome peasant to whom during the day I had given a few baiocchi for some little service rendered.

Herculaneum is situated nine English miles to the westward of Pompeii. It was overwhelmed, as is well known, with material more solid than that which came down upon the latter city. And sheets of fluid have flowed over its site since its first obliteration. So that now the excavations have to be made as in a quarry of solid rock, to a depth varying from 70 to 112 feet. Care is taken, when any additional building has been opened and searched, to throw back the material into its former place—lest the superincumbent mass, on which the present town of Resina is built, should break through. Consequently, the parts which you are enabled to examine are limited. With the aid of torches, the shape and dimensions of the theatre—capable of accommodating 8,000 persons—can be well made out, where it is a curious thing to see the capitals of pillars embedded, like ammonites or portions of the mastodon, in almost solid rock. From Herculaneum have been derived some of the most interesting of the objects in the Museo Borbonico in Naples. In a villa here were found the striking statues of Æschines and Agrippina, authentic busts of Plato, Socrates, Demosthenes, Scipio Africanus, Seneca, and others, with beautiful bronzes—some of them made to look life-like by the insertion of glass eyes. But its most interesting relics are the papyri-rolls, resembling brown charred sticks, two inches in diameter, and from six to eight inches long. Some of them—displayed now under convenient glass-cases—have been successfully unrolled and decyphered. But the regretted decades of Livy and History of Sallust are desiderata still. No works of importance have been discovered, with the exception, perhaps, of a treatise by Epicurus, entitled "De Natura."

Stabiæ, overwhelmed also in A.D. 79, and situated under a portion of the modern town of Castellamare, four English miles eastwards from Pompeii, has ceased to be examined. Having been reduced to ruins by Sulla in the course of the Marsic war, B.C. 91, it is not supposed to be so rich in relics as the two towns which have been excavated. Oplontis, a small Roman village, overwhelmed with its more distinguished neighbours, was cut into during the construction of the Western Railway from Naples, about two miles eastward from Herculaneum; a few mosaics and sculptured animals were found.

(To be continued.)

On the Establishment of a System of Simultaneous Meteorological Observations, &c., throughout the British North American Provinces.

By Major R. Lachlan of Montreal. Read before the Canadian Institute, March 18th, 1854.

Conceiving it to be the duty of every well-wishing member of the Canadian Institute, whether residing in Toronto or at a distance, to take every available opportunity to contribute his mite, however humble it may be, to its literary and scientific treasury, I offer no apology for venturing to draw its attention towards two highly interesting philosophical objects which I have long had at heart, and which, if zealously undertaken and perseveringly carried out, would not only be most creditable to the Institute, as valuable contributions to the advancement of science, but even prove very beneficial to our rapidly improving country.

I allude, in the first place, to the institution of a well organized chain of daily *simultaneous* meteorological observations, at a number of well selected stations all over Canada, with Toronto for its centre, to be connected with a similar arrangement to be invited to be set on foot in each of the Lower Provinces, and so conducted as to be readily united with the extended system of Meteorological Registers already in operation in the United States, under the fostering auspices of the Government and the various philosophical associations of that country. I advert, in the second place, to the establishment of a similarly simultaneous record of the rise and fall of the great Canadian Lakes, throughout their whole extent.* Of which more hereafter.

Having so far hinted at the mere outline of the undertaking contemplated by me, I may perhaps be permitted, though at the risk of prolixity, to advert by way of further preliminary, to the simple and inexpensive means by which I had *originally* proposed to accomplish my objects, while I at the same time frankly acknowledge these to fall short of the scientific standard to which we may now reasonably aspire, with the Provincial Magnetic Observatory and the Canadian Institute for our guides.

I proceed, then, to observe that it is more than ten years since I first ventured to propose to Dr. Cragie of Hamilton, a well known excellent meteorological observer and recorder, whose name I rejoice to see lately enrolled as a member of the Insti-

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* See Notes appended to the annexed Tables, No. 2.

tute—the following brief and imperfect outline of what I then wished for, as being the most unpretending, or, at least, most natural way of connecting myself with the undertaking *now* proposed, and at the same time evincing the long-continued interest I have taken in its object.

"You will perceive (I observed in a letter to Dr. C.) in my late Discourse,* a wish expressed by me for a *simultaneous* set of comparative meteorological diaries being kept in different parts of the country, with the view of ascertaining the various shades of *climate* in different quarters; and I had it in contemplation to invite the co-operation of several gentlemen, either individually or through the medium of the various existing philosophical societies in the accomplishment of the object; and, among others, I looked particularly to the then unknown keeper of the Ancaster Register, Dr. C. As circumstances have turned out, however, I now at once frankly avail myself of the opportunity of giving you an outline of what I would suggest, and shall be glad to be favored with your opinion on the subject.

"I would propose that the different Registers should be all kept in the same form, and include the variations of the barometer as well as of the thermometer; but I fear this would not be so easily accomplished, from there being so few barometers in this country. Those, however, who possess no barometer might leave the column for that instrument blank; and I would wish the registry to be at the same hours, and at least at four daily periods; and that a column should be allotted for the direction of the winds; and also that the weather column should include, among other et-ceteras, the wind's rates, and any temporary extra variations of either barometer or thermometer. The form would accordingly be as follows:—

"Meteorological Register kept at———.

Date.	Thermometer.				Barometer.				Winds.		Weather, &c.
	6 a.m.	9 a.m.	2 p.m.	9 p.m.	6 a.m.	9 a.m.	2 p.m.	9 p.m.	a.m.	p.m.	

The thermometer at each place to be of course exposed to the same aspect, *i. e.*, the north. A Rain Table could also be kept separate. But to ensure uniformity, the size and form of all the rain guages should be the same, and the entries made in exactly a similar way, which may be easily pre-arranged. If you should approve of the above, let me know, and I will prepare a sketch of the thing in time to be submitted to our little society at our next quarterly meeting, with the view of entering into a correspondence with the different philosophical societies on the subject."

No sooner had I proposed the above than I became persuaded that, with very little additional trouble, another interesting philosophical object which I had equally long had at heart could be readily connected therewith—namely, a daily Register of the fluctuations in the level of the great Lakes, so as, in a reasonable number of years, to set at rest not only the disputed existence of the *traditional septennial flux* and *reflux* of their waters, but also the extent of the better known *annual* variations in their level; at the same time that the facts gradually recorded would either tend to confirm or demolish a theory long entertained by myself, that, though there is no regularly recurring flood in any of our Lakes, and far less a simultaneous septennial flood in them all, there is a tendency to irregular independent floods in each; or, in other words, that it may be at the flood in one Lake, while it is at the ebb in another. As, however, I propose laying the results of my accumulated notes on this interesting subject before the Institute in a connected form, at some future time, I forbear further alluding to it at present than as a debateable philosophical question, well worthy of being more fully investigated, and which I therefore propose incorporating with the suggested system of meteorological observations.

With regard, then, to the latter and principal branch of the subject, I would further observe, that having, about a year ago, when President of the Natural History Society here, had occasion to correspond with our late distinguished President, Capt. Lefroy, I availed myself of the opportunity for adverting to my old favourite project, and expressing a hope that it might at last be happily carried into effect under his scientific auspices, with the lines of electric telegraphs acting as magically powerful assistants!—a hope in which I was about the same time encouraged by another talented meteorological observer, Dr. Smallwood of St. Martins,† as well as by Judge McCord. But I found that I was unfortunately too late; as Captain Lefroy informed me that "he was then busy preparing to leave Canada, and that it would therefore be out of his power to co-operate, as he should otherwise have been delighted to do, in any extended meteorological scheme." He, however, frankly "referred me for information on so desirable a subject to the report of the British Association for 1851 (p. 320); and also to that of the American Association for the same year, for an account of what was doing in this way in the United States;" and he further suggested "that the Natural History Society could not do better than invite a communication from the Smithsonian Institution at Washington, as to what they wished to be effected in Canada, and express a wish to co-operate." Captain Lefroy at the same time observed that "he greatly desired to see extensive observations organized in Canada, but that it must be a work of time; and that the acquisition and comparison of the instruments alone would take a season; and also that there should be a station at least every 100 miles from E. to W., and from N. to S., on the line of the Ottawa. With regard, also, to the expense, he considered that about £10 per station would be sufficient, exclusive of publications, to furnish barometer, wet and dry thermometer, rain guage, and wind vane, &c.

To this encouraging quotation from Captain Lefroy's characteristically frank, though hurried valuable hints, I regret to add that, though I have lately been enabled to refer to the proceedings of the American Association alluded to by him, as will be found evinced in some apposite extracts therefrom, I have as yet been unable to meet with the report of the British Association; and also that, during the time I continued to fill the office of President of the Natural History Society, I unfortunately never felt myself in a sufficiently encouraging position to attempt to carry out Captain Lefroy's suggestion for opening a communication with the Smithsonian Institution. It will, therefore, be for the Canadian Institute to consider whether that creditable leading step shall be taken by it, should my project be deemed worthy of adoption; and to enable it to judge, it now remains for me to state my own unpretending ideas on the subject, and then leave the matter for mature deliberation by a special committee at as early a day as may be convenient.

* The discourse alluded to will be found appended to a small Pamphlet, which I take the liberty of transmitting herewith, as further evidence of my having been a humble well-wisher to the advancement of useful knowledge.

† It is alike due to Dr. Smallwood and Captain Lefroy to state here, that the following were the terms in which the former expressed himself in a letter, dated 12th January, 1853:—"I will aid and assist you to the best of my abilities, and go heart and hand in any plan you may adopt, more especially under the masterly guidance of Captain Lefroy, who, from his great scientific acquirements, will give one and all full confidence in any plan of proceeding he may suggest."

1st. It appears to me that both branches of the undertaking, though resting on a philosophical foundation, are so decidedly and essentially of a useful and beneficial *public* character, that the Government should liberally bear a part in promoting them; but that, *as done in the United States*, that should be limited to the expense of furnishing a set of well-adjusted instruments for each station of observation, and otherwise evincing its readiness to promote the execution of the work by authorizing all such public officers as harbour-masters, lighthouse-keepers, and collectors of customs, as it may be desirable to invite to act as local observers to give their valuable assistance. 2dly. That the Commander of the Forces should also be solicited to aid the undertaking, by authorizing all medical officers in charge of military hospitals to furnish the Institute with a copy of the Meteorological Record transmitted by them periodically to the Inspector-General of the Medical Department of the Army in London. 3dly. Nor should the expectation of the very valuable co-operation of the Governor of the Hudson's Bay territory be overlooked. In addition to which powerful public support, I would, 4thly, respectfully invite the co-operation of every University and College, and other educational institutions, as well as of every association for the advancement of knowledge, throughout the Province, whether known by the more dignified titles of literary and scientific, or the less imposing though highly influential names of Mechanics' Institutes, or agricultural, mercantile, or other literary associations; in short, every public or private individual of known philosophical and observant repute in suitable parts of the country; among all whom, I am persuaded, an efficient corps of zealous and accurate *volunteer* observers would ere long be enrolled, that would do equal justice and credit to the undertaking. Nor need we stop there; for, as elsewhere hinted, I am convinced that it only requires to place our patriotic object in a proper point of view to induce the public-spirited directors of our now wide-spread lines of electric telegraphs to add also, to a reasonable extent, their gratuitous valuable co-operation in the laudable undertaking.

What, then, it may now be asked, are the great public benefits expected to be derived from the proposed arrangement? And what is the system of observations to be adopted? As regards the more important meteorological branch of the subject, I am fortunately able to reply, that instead of presuming on any fancied merits in my own unscientific predilections and observations as accumulated from year to year, I am prepared to adduce the far more authoritative language of the American Association for the Advancement of Science, which has for some years been so ably emulating the noble example in our own loved fatherland, as recorded at their great meeting at Albany in 1851, at the instance of their zealous associates, Professor Guyot of Cambridge, Massachusetts, and Doctor Hough of New York.

On that occasion the former of these gentlemen read a paper on the progress of the system of meteorological observations conducted by the Smithsonian Institution, and the propriety of its immediate extension throughout the whole North American continent and West Indies, in the course of which he showed the importance of these observations to a thorough knowledge of meteorology, and circulated plates and sheets prepared for the direction of observers, and exhibited the instruments provided by that Association, as well as printed tables exemplifying the results which had been obtained in one place, from observations taken three times a day, at 6 A.M., 2 P.M., and 10 P.M., of the meteorological state of the atmosphere, as follows—the phases of the moon; the barometrical indications; the height of the thermometer; the direction of the wind; the state of the psychrometer; the force of the vapour; humidity; state of rain-guage; state of the clouds; plants in flower; migration of birds; and various other notices. The Professor also observed that there were but fifty places as yet established, and pointed out various other wide-spread positions at which observations ought to be taken, ranging from the mouths of the Columbia to the St. Lawrence, from San Francisco to Washington, from the Gulf of California to the Rio-del-Norte, from the Pacific across the plateau of Mexico to the West Indies, from the Isthmus of Tehuantepec at Nicaragua Lake, at the plateau of Costa-Rica, and at the Straits of Panama to Chagres.*

Following up the same interesting subject, Dr. Hough, in another article on the meteorological observations carried on in the State of New York, from 1825 to 1850, observed—*what is well worthy of attention and imitation in British America*—that in the year 1825, the Regents of the University of New York, following the example of the Federal Government in its instructions to the commandants of its various military posts, issued orders to the several academies subject to its visitation, requiring them to cause meteorological observations to be made after a specified form and with instruments furnished to them for that purpose. These observations, like the foregoing, embraced three daily records of the thermometer, with the direction of the wind and the appearance of the sky, as clear or cloudy in the forenoon and afternoon: a record of the rain guage, and such observations on storms, meteors, auroras, and the progress of vegetation, &c., as might be deemed worthy of note; and that this system of observations was maintained with more or less regularity for twenty-four years by sixty-two literary institutions; and the results, published annually in the reports of the Regents, had been acknowledged, both in the United States and in Europe, as valuable contributions to the science of meteorology; but were discontinued in 1849, to give place to the present thorough and efficient course of observations.

Dr. Hough then observed that these twenty-five years' observations, though without value in determining the extent and progress of storms and the various atmospherical vicissitudes indicated by the delicate instruments now in use, were invaluable in establishing the laws of climate, the mean temperature, depth of rain, and general character of the weather, &c., and that he had in consequence undertaken the labour of reducing the entire series of these records, with the intention of offering the results, when completed, to the State Legislature for publication; and therefore solicited the Association to refer the examination of the details already prepared to the meteorological committee, with the view of their expressing an opinion of their merits, and recommending them, if thought worthy of it, to the favourable notice of the Government.†

The meteorological committee accordingly undertook this duty and concluded their labours by not only reporting favourably, but also recommending the appointment of a special committee to memorialize Congress in behalf of the immediate extension of the system of meteorological observations now under the Smithsonian Institution; and that the Secretary of the Treasury should provide the means; and further recommending the selection of fifty additional stations (similarly supplied with instruments); and also, after (as will be found quoted nearly verbatim below) enumerating the various benefits to be expected from a wide-extended system of scientific observations, proposing to supply

* See Report of the Proceedings of the American Association, held at Albany in 1851, pp. 167-8.

† See Report of the Proceedings of the American Association, held at Albany in 1851, pp. 171-2.

the primary stations with a full set of instruments carefully compared and of uniform construction (as tested and graduated by the Smithsonian Institution), consisting of a thermometer, barometer, hygrometer, rain and snow guage, and wind-vane or anemometer; and also to cause *hourly* observations to be made at six or eight stations, and three times a day at all others; and concluded their resolutions by proposing to enlist in the good cause, not only their own Government and Surgeon General, but also the Canadian Government and the Hudson Bay Company, and suggesting that Kingston and the Manitoulin Islands should be selected as Canadian stations.

"We expect (observed the committee)* to derive from systeatic observations [such as proposed] a thorough knowledge of the climate in all its relations, and of its variations in the same and in different localities. The mean temperature of points is to be determined with carefully verified instruments, similar to each other, similarly placed, and observed under the same rules and conditions; the lines of equal mean temperature will result; and the variations at different seasons will be shewn; the limits of vegetation will be found; and the areas of climate adapted to the cereals; the parallels within which wheat, Indian corn, &c., may be profitably cultivated; and (which present results so different from those found to exist in the eastern continent of Asia) will be accurately determined; the degree of dryness and moisture will be ascertained; as also the amount of rain and of evaporation—questions not only bearing on the health and comfort of man, but on his attempts to facilitate communications by canals, and the improvement of rivers, and on the means of avoiding and controlling floods and freshets. The number of days of rain, the number of clear and cloudy days, and the amount of loss of the sun's effect by cloudiness will be determined. The direction and force of the wind, and the system of winds prevailing in different parts of the country and at different seasons of the year. The mean pressure of the air and its variations will be shewn by the barometer; from which important data in regard to the relative height of points may be obtained, giving the general topographical features of the country, and serving as a recommendation in distant parts of it, for proposed railroads or common roads. The progress of waves of pressure, either connected with storms or with the ordinary fluctuations of the atmosphere, will be ascertained. All periodical phenomena will be studied in connection with these observations—the flowering of plants and trees, the ripening of grains and fruits, and the migration of animals. The frequency and intensity of the borealis will be determined, and its singular variations, in passing from north to south and from east to west, will be studied. The direction of the motion, the frequency and intensity, and other circumstances actuating on thunder-storms will be ascertained. From these observations will result a knowledge of the law of storms in its full developement, and its application ascertained; so important to the farmer and navigator—so interesting to the man of science—and so desirable to be known by every one who travels on our lakes or rivers, and extensive and sometimes stormy coasts. The line of telegraphs will be rendered available for observation on the subject, more complete than any which have been hitherto practicable; and while they will enable us to determine the laws of storms, will also furnish the means of giving notice of their approach. The diseases incident to different climates, the phenomena of malaria, and the progress and laws of epidemics may be studied in connection with the periodical phenomena from carefully connected stations."

* See Proceedings of the American Association, held at Albany in 1851, pp. 398 to 400.

Deeming it unnecessary to offer any apology for so appropriate though lengthy a quotation as the foregoing, I now proceed to observe, in as concise terms as possible, that I would respectfully propose the adoption *in Canada* of the very same system of observations, with one additional column for the daily registry of the fluctuations in the level of the waters of our great Lakes (or, where a station happens to be on the bank of a river, the rise or fall in its stream),† as exhibited in the annexed blank Table No. 1, as well as in that marked No. 2; showing, by way of climatic example, the very different results of the observations actually recorded near Montreal, and at Toronto, on the 1st days of January, April, July, and October of the same year; and I would further venture to suggest that the following places, at least, should be selected as suitable meteorological stations, though many more might be judiciously added, viz.:—1. Gaspé Basin; 2. Kacoona; 3. Quebec; 4. Montreal (or St. Martins); 5. Cornwall; 6. Bytown; 7. Kingston*; 8. Belleville*; 9. Colborne Harbour (or Presqueisle)*; 10. Peterborough; 11. Cobourg; 12. Toronto; 13. Barrie, on Lake Simcoe; 14. Penetanguisheen, on Lake Huron*; 15. Hamilton*; 16. Port Dalhousie*; 17. Port Colborne*; 18. St. Thomas*; 19. London; 20. Amherstburgh, or Bois-blanc Island*; 21. Port Sarnia*; 22. Goderich*; 23. Great Manitoulin Island*; 24. Bruce Mines*; 25. Sault Ste. Marie, above the Rapids*; and 26. Some station on the western extremity of Lake Superior, say at the mouth of the Pic River:—all the places marked thus * being also intended as stations for observing the rise and fall of the waters of the Lakes, regarding which it is now necessary to add a few explanatory words.

The existence of various periodical fluctuations in the level of our vast Lakes has long been beyond a doubt; but not so, as far as I am yet aware, the various *causes* by which they are produced, or the laws by which they are governed. Independent of the great septennial flux and reflux assigned to them by tradition, and on which a course of observations such as that proposed would in time throw much light—it has long been a question of lively philosophical interest, how far, in the absence of any great feeders in the form of rivers, their *annual* variations are regulated by the amount of rain and snow which falls in their proximity, united with supposed supplies from internal springs, combined with the greater or less evaporation during each summer season; as is also how far the *daily* and even more frequent temporary fluctuations in their levels, are owing to the direction and force of the winds which happen to sweep along their surface during the time.‡ Add to which it will be very desirable to ascertain, by a course of long-continued observations, having reference to the phases of the moon, and other natural phenomena, how far those sudden and uncertain alleged tides, termed "Seiches," described by several writers as observable in some of the inland European lakes, and attributed to unequal atmospheric pressure, are also recognizable in those of America.§

Not doubting that the results would prove highly satisfactory and instructive, I deem it sufficient to add that, of course, the

† It will be admitted that watching the rise and fall of rivers with a philosophic eye is not altogether new to me, when I add that it is now near forty years since, in India, I kept a minute record of those of the great Ganges for a whole season, through a range of between thirty and forty feet; little dreaming that I should ever be in so near a position as at present to learn that those of the equally great and far-famed Mississippi are nearly the same.

‡ See Letter introductory to this Paper.

§ See Young's Natural Philosophy, Vol. I., p. 578; and 16th Vol. of American Journal of Science, pp. 78 to 83; and also 2d Vol. of the Canadian Journal, p. 25.

tide guage, or lagometer—if the measuring instrument used may be so termed—would require to be self-registering, a mechanical contrivance involving no great ingenuity, and that it would also be necessary to establish beforehand a *Zero* point having reference to the supposed level of the whole of the lakes at the time of commencing the various simultaneous registers, compared with their known or assumed state at some remarkable bygone periods. In my own mind that might be a matter of some little difficulty, as I am inclined to regard each lake as liable to be acted upon by circumstances peculiar to itself; but as a general rule, intended to establish some definite starting point for the whole chain of observations, I would be disposed to take either the level of the sea as the acknowledged zeros, or, in the absence of more positive data, be content to make the lowest ascertained level of Lake Ontario during the past season answer the purpose, and have the guage so adjusted that the surface of the water at the time of recording the first observation, should indicate its relative height above the assumed Zero point. It would also, of course, be advisable to insert beforehand, in the column of remarks, the dates of the full and change and other quadratures of the moon, as well as of the apogee and perigee, from some correct almanac, with the view of duly noticing whether or how far these have any tidal influence on inland lakes.

Much more might be added to the foregoing very desultory and imperfect sketch; but feeling myself incompetent to enter into scientific minutiæ on such a subject, I prefer acting as the humble *pioneer*, and leaving the matter to be elaborated by more competent members of the Institute in such a manner as its philosophical importance deserves; and, therefore, with this view I beg to conclude, with respectfully proposing that a *special committee* be appointed to investigate and report on my project, and that, should their report prove favorable, an immediate energetic appeal should be made to the Government and Legislature in behalf of the accomplishment of the object, in the same manner as adopted by the American Association, and that similar appeals should be addressed to the Governments of New Brunswick, Nova Scotia, and Prince Edward's Island, invoking their cordial co-operation in the patriotic undertaking.

All that now remains is to tender my apologies for the unavoidable great length of the above desultory communication, and to express a hope that, however imperfect it must prove as emanating from one who does not pretend to any acquirements as an astronomical or otherwise scientific observer, it will not be altogether unacceptable; and that, at all events, it will not be regarded as an act of idle supererogation in a member of the Institute, who, whatever may be his deficiencies, is disposed to yield to none in long-continued, ardent good wishes for the general advancement of scientific research.

R. LACHLAN, *M. C. S.*

Montreal, 2d March, 1854.

Meteorological Table.—No. 1.

Form of Daily Meteorological and Lake (or River) Register. Kept at ____________ *during* ____________ 185__.

Date.	Barometer.			Thermometer.			Hygrometer.			Anemometer. Wind's direction.			Anemometer. Wind's force.			State of atmosphere.			Rain Guage		Level of Lake (or River)			Remarks on phases of moon, borealis, zodiacal lights, comets, storms, & other phenomena.
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	A.M.	P.M.	6 A.M.	2 P.M.	10 P.M.	
*1	29·515	29·444	29·821	9	7	0	1·00	0·92	1·00	N.E.	N.	N.N.W.	21·30	7·12	Calm.	Str.	Clear.	Clear.	0	9·50				Moon, last quarter,
2																								[4.37 P.M.
3																								
4																								
5																								Perigee, 0·1.
6																								
7																								M. new, 10.36 A.M.
8																								
9																								
10																								
11																								
12																								
13																								
14																								
15																								
16																								M. 1st qr. 0.12 A.M.
17																								[Apogee 5 A.M.
18																								
19																								
20																								
21																								
22																								
23																								
24																								M. Full, 0.26 A.M.
25																								
26																								
27																								
28																								
29																								
30																								

* The figures inserted in the first day of the month, by way of example, correspond with those noted at St. Martin's, near Montreal, on 1st January, 1853.

Meteorological Table.—No. 2.

Specimen Tabular View of four days' Meteorological Registers, as kept *simultaneously at St. Martin's, near Montreal, and at Toronto; showing the great difference in Local Temperature, Winds, and Weather, at the two places of observation, on the first day of each quarter, in the year 1850.†**

Place & date.	Barometer.			Thermometer.			Hygrometer.			Anemometer. Wind's direction.			Anemometer. Wind's force.			State of atmosphere.			Rain Guage.	Level of lake (or river).	Remarks on phases of moon, borealis, zodiacal lights, comets, storms, & other phenomena.
Montreal, Jan. 1.	29·615	29·744	29·821	9	7	0	1·00	·92	1·00	NE	N	WNW	1·30	7·12	Calm.	Str	Clear	Clear	0 9·50	0	
Toronto, „	·526	·684	·784	23·2	26·9	21·2	·85	·87	·94	N	NW b N	Do.		0			0		0	0	
Montreal, April 1.	·593	·604	·739	35	53	82	·69	·72	·80	NE b N	S b E	N b E	0·00	5·15	·008		Clear		0	0	Zodiacal lights;
Toronto, „	·481	·578	·688	34·8	46·7	34·8	·93	·55	·56	N b E	N	NNW		0			0		0	0	[aurora.
Montreal, July 1.	·573	·504	·518	67·2	75·6	60·0	·81	·58	·66	NW b N	Do.	Do.	6·96	5·33	12·05	Clear	Cum. str.	Clear	0	0	
Toronto, „	·628	·635	·650	64·3	71·2	60·0	·88	·71	·83	N b W	S b W	NNW		Mean 4·38.			0		0	0	
Montreal, Oct. 1.	·303	·339	·372	37·5	60·7	47·6	·83	·71	·86	S	WSW	S b W	5·80	6·27	1.18	Clear	Clear	Overcast	0	0	
Toronto, „	·512	·446	·374	46.5	58·2	53·80	·77	·55	·91	N b E	S	S		Mean 3·04			0		0·085	0	

* It will be readily understood that the term *simultaneous*, as generally used in all such registers, though apparently a correct one, is not actually so, arising from the difference of longitude between each place of observation; and that to approach at all to a state of correctness in a really simultaneous view of the state of the thermometer, winds, weather, &c., it will not only be necessary to keep *hourly*, but even far more numerous observations; instead of three times a day, and to have each particular observation reduced to the true time by corrections for the difference of longitude, as well as for the wind's rate. The term, however, is sufficiently applicable to general purposes; and the observations can be readily reduced to more minute correctness, when systematically arranged in a tabular form for more exact philosophical application.

† These days are taken at random, as comparative specimens of the mere difference of climate at two places, with but three degrees of latitude between them; but there is a far higher philosophical object in view, namely, to arrive at a knowledge of the causes of such great differences as are exemplified in different parts of the Province, to a far greater, and yet, in a great measure, unaccounted for extent. As, for instance, while a friend writes to me from Sandwich on the 14th February, that "yesterday and the day before were perfect May days! no snow, no sleighing! and the river (Detroit) quite open!" The thermometer, as registered on the banks of the ice-bound St. Lawrence, at Montreal, stood as follows:—

	Night. Max.	Night. Min.	Day. Max.	Day. Min.
12th.	—6	+6	—6	—9·6
13th.	—3	+10.5	+15	+36·0

No small difference!

Remarks on the Intrusion of the Germanic Races on the Area of the Older Keltic Races of Europe.

By Daniel Wilson, LL.D., Professor of History, University College, Toronto. Read before the Canadian Institute, April 1st, 1854.

Dr. Arnold, in that beautiful but imperfect narrative of Roman History which his lamented death arrested in its progress towards completion, after devoting a chapter to the description of the general condition of Europe at the commencement of the fourth century before the Christian era, thus concludes:—"Such was the state of the civilized world, when the Kelts, or Gauls, broke through the thin skreen which had hitherto concealed them from sight, and began, for the first time, to take their part in the great drama of the nations. For nearly two hundred years they continued to fill Europe and Asia with the terror of their name; but it was a passing tempest, and, if useful at all, it was useful only to destroy. The Gauls could communicate no essential points of human character in which other races might be deficient; they could neither improve the intellectual state of mankind nor its social and political relations. When, therefore, they had done their appointed work of havoc, they were doomed to be themselves extirpated, or to be lost amidst nations of greater creative and constructive power; nor is there any race which has left fewer traces of itself in the character and institutions of modern civilization."

We must not, however, too hastily assume the extirpation of any race, or the altogether transitory and evanescent influence of its physical or intellectual peculiarities, merely because it ceases to play an independent part as a distinct nation. To those who recognize in all its fullness the influence of primary ethnological differences on national character and institutions, it cannot be doubted that the intermixture of races has largely affected the character of nations. The ancient Pelasgic and Etruscan races have disappeared, yet probably not by extirpation but absorption; and perhaps contributing, in no slight degree, by their diverse ratios of intermixture with Hellenic and Kelto-Italian blood, to produce the permanent differences between the two great nations of classic antiquity.

That the Keltic ethnological element has exercised no beneficial influence either on the intellectual or physical condition of medieval and modern Europe, is no less problematic. The blood of the Gaul still gives no partial hue to the complexion of Gallic France, nor can we assume that no portion of our peculiar Anglo-Saxon national character—so different, in some respects, from that of our continental Saxon congeners—is derived from the early intermixture of the Saxon and Scandinavian with the native Celtic blood. The invasion of the Anglo-Saxons, as of the Danes and Northmen, was one of warriors, not of colonists with their wives and families, and their first settlement must have involved some extent of alliance and mingling of races, such as we see taking place in our own day with aborigines whose physical and moral characteristics present a far more antagonistic diversity of aspect. But viewing the ancient Gauls as they first appear on the stage of history, unaffected as yet by those Germanic or Anglo-Saxon elements which temper

"The blind hysterics of the Celt,"

the justice of one portion, at least, of Dr. Arnold's remarks may be perceived if we look to the transitory nature of the Keltic philological influence on our own English tongue, and consider that while, for upwards of seven centuries after the date here referred to, no other intrusion of foreign races had taken place in the British islands than the very partial military occupation by the Roman legions, yet the English language retains no grammatical or constructive elements of the ancient native Keltic or British tongues, and has so few etymological elements incorporated into its composite vocabulary, excepting such as are indirectly derived through the Latin, that the whole of such

might be expunged without sensibly marring the richness and copiousness of the language. Historically speaking, the English language of the British islands stands in precisely the same relation to its ancient geographical area as the English of Canada does to this portion of its widely diffused modern area; in neither is it the original language of any part of the countries to which it now pertains, but in both cases it has spread itself within well ascertained, though diverse periods, at the expense of earlier and more aboriginal languages, which it has displaced and superseded.

Looking, however, upon the older ethnological stock of British and European population, to which the Keltic elements of European languages and customs are traceable, it is important to consider whether the well-ascertained date of its first appearance on the stage of history above referred to, in any degree coincides with that of its earliest intrusion into Europe, or with the appearance of that other hardy barbarian stock, which, issuing at a later period from its fastnesses in the old unexplored north, swept before it, in its young strength, the decrepid vestiges of Rome's Imperial decline? In other words, I would inquire if the Keltic and Germanic races are coeval in their origin, or in their occupation of the European areas which they are found in possession of at the dawn of history?

"We can trace," says Dr. Arnold, "with great distinctness the period at which the Kelts became familiarly known to the Greeks. Herodotus only knew of them from the Phœnician navigators; Thucydides does not name them at all; Xenophon only notices them as forming part of the auxiliary force sent by Dionysius to the aid of Lacedémon; Isocrates makes no mention of them: but immediately afterwards, their incursions into Central and Southern Italy on the one hand, and into the countries beyond the Danube and Macedonia on the other, had made them objects of general interest and curiosity; and Aristotle notices several points in their habits and character in different parts of his philosophical works." Like the first glimpses of the Kassiterides or Tin Countries of Southern Britain, we discern only vaguely and by chance incidental notices, the western Kelts, described by Herodotus as a people who "dwell without the pillars of Hercules, and bordering on the Kynesians who live the farthest to the west of all the nations of Europe."* Few passages of ancient history convey to us a more vivid impression of the complete isolation of the diverse tribes then scattered over the European continent. The Pyrenees and the great Alpine chain, spreading eastward to the head waters of the Danube, formed in the age of the Father of history, a barrier of exclusion for all the Transalpine races, scarcely less effectual than that which, for upwards of eighteen centuries thereafter, concealed this great antiquity, America, from the eyes of Europe. Kelts, Kymric or Gaelic, had doubtless crossed the Alps long prior to the first notice of them by Herodotus, and had established themselves in the fertile valley of the Po, as well as extended their influence far southward into the Italian peninsula. Whether, at that period, they had ever been present on any portion of the Hellenic area of Greece, may well be questioned, nothwithstanding the undoubted Keltic elements recognized in the Greek language. They had, however, already passed to the south of the Pyrenees, and intermingling with the older Iberians of Spain, constituted the ancient Keltiberian population of Arragon and Valencia: unless, indeed, we are prepared to recognize in the Keltæ and Galatæ of Aristotle and Diodorus something more than varied forms of the same name; though even then, the distinction will not necessarily imply a greater one than the philologist recognizes between the Keltic elements of the ancient Greek and Latin, or the ethnologist perceives to separate the modern Gael and Kymri of Great Britain.

To the Greeks of the age of Herodotus the Kelts were only known, by the chance report of some Phœnician seaman, as one among the rude tribes of the barbarian West, where the coasts of Europe intruded furthest into the mysterious Atlantic main, which was to them the aqueous boundary of the world. The Greeks of that age little suspected that these same western Kelts reached from the shores of the Atlantic Ocean as far as the Alps, and overflowing and sweeping round them, already occupied the valley of the Po, and extended nearly to the head of the Adriatic. "The narrow band of coast occupied by the Ligurian and Venetian tribes," says Dr. Arnold, when referring to the approaching Gaulish invasion of Rome, "was as yet sufficient to conceal the movements of the Kelts from the notice of the civilized world. Thus, immediately before that famous eruption which destroyed Herculaneum and Pompeii, the level ridge which was then Vesuvius excited no suspicion; and none could imagine that there were lurking close below that peaceful surface the materials of a fiery deluge, which were so soon to burst forth, and to continue for centuries to work havoc and desolation."

But though that celebrated eruption which took place in the first century of the Christian era is the earliest on record, it is well known to the geologist that the pent-up fires of Vesuvius and Solfatara had long before overflowed the Phlegræan fields; and, in like manner, the philologist recognizes, on no less indisputable evidence, the traces of earlier Keltic intrusions than that which, in the fourth century of Rome, swept like a wasting torrent over Cental Italy. The attention of the members of the Canadian Institute has recently been directed to the well known Keltic element now universally recognized as forming so important a constituent part of the Latin tongue. This Professor Newman assumes to be an essentially intrusive element; but in doing so he recognizes it as derived from Italian races, which, if not aboriginal, are known to us as the primitive inhabitants of well-defined areas of the Italian peninsula at the very dawn of history. Among these Keltic Italians the Umbrians and the Sabines are specially remarkable, and the essential* Celtic character of the Sabine clanship, out of which the later Roman clients, and the whole system of Roman patron and client, patres and plebs, were naturally developed, points to a social condition prevailing among the ancient tribes of Central Italy, and especially among the Sabines, more easily explicable by the analogies of modern Celtic clanship as it existed in Scotland down to the middle of the eighteenth century, than by any other source which history discloses to us.

Assuming, with Prichard, Newman, and other able philological critics, the Kelticity of the Umbrians, and the Kelto-Italian character of both the Umbrians and Sabines, we are left

* This description Dr. Latham would refer to the Kelts as Iberian, and not to the *Kelts* in the general sense in which the designation is accepted, and as it was understood by the Romans in the time of Cæsar. But it is not at all improbable that the population of Gallicia and the Biscayan provinces of Spain might have been purely Gallic B.C. 400, and yet that the displaced Ibéri of the south might have even crossed the Garonne in Cæsar's time. Immense displacement had taken place during the interval in the Spanish peninsula. But the name *Garonne*, like the Scottish *Garry*, is essential Celtic and descriptive: *the rough river*.

* For the purpose of discriminating between the undoubted modern Kelticism of the Gael, Kymri, &c., of the British Isles and Bretagne, and the assumed but disputable Kelticism, in this sense, of some ancient ethnological elements—*e. g.*, the Celtiberians of Spain—the term *Keltic* is employed here in reference to all ancient and purely continental elements, that of *Celtic* to all modern and British elements.

in no doubt as to the antiquity of the Keltic ethnological element in Southern Europe. Among the primitive native Italian populations, the Umbrians were, at the earliest times, the cultivators of the soil and the builders of cities; and their ancient capital, Ameria, was one of the oldest cities of Italy. Pliny assigns the date of its foundation 381 years before that of Rome. Specimens of the language of this people have been preserved to us in the celebrated Eugubine Inscriptions, discovered at Gobbio, the ancient Iguvium, and the relation of this language to the Latin has been satisfactorily assigned by Grotefend and others. But without attempting to determine how far the famous Sabines and Latins, or the less important tribes of Piceni, Vestini, Frentani, and Marsi, which clustered around their ancient areas on the east, approximated to the Umbrian type, it is sufficient for our present purpose to know that "the primitive Latin must have Keltized itself by imbibing Umbrian," (*Newman's "Regal Rome,"*) and that the Keltic element of the Latin is derived, being isolated and fragmentary, and only traceable to its etymological family-groups by a reference to the surviving Celtic dialects: we are hence left in no doubt that that appearance of the Kelts or Gauls in Central Italy, B.C. 389, which Dr. Arnold has characterized as their "beginning for the first time to take their part in the great drama of the nations," was by no means their earliest intrusion into Southern Europe. Dr. Latham, who is little disposed to extend the Keltic area further than the strictest evidence will sanction, and even denies the Kelticity of the element mingling with the Iberian stock to constitute the Celtibéri of Spain (*Ethnology of Europe*, p. 37), in restricting the original area of this ancient race, remarks:—"I am inclined to limit the Keltic area, at its maximum extension, to Venice westwards, and to the neighbourhood of Rome southwards. But this is not enough," he adds, "they may have been aboriginal in parts which they may seem to have invaded as immigrants."—(*Man and his Migrations*, p. 169.)

It may thus be assumed as obvious and undoubted, that the invasion of Rome and Central Italy by the Gauls was no intrusion of a new race, like the first appearance in Europe of the Huns in the fourth century, or of the Moors in the eighth century of our era. May it not, however, indicate to us other intrusions of which it was a secondary cause? My belief is, that it does. It is abundantly obvious that some great cause of dismemberment and revolution was then affecting the great Keltic race. Whatever their older area may have been, we find the Kelts soon after intruding into Thrace and Illyricum, and appearing on the borders of Macedonia in the reigns of the great Philip and Alexander. They even overflow into Asia; and, for nearly two centuries, glance, meteor-like, on the pages of ancient history, the dismembered relics of an old barbarian nationality, terrible though transient in the destructive influences of its scattered fragments. This was the waning struggle of the great Keltic stock. Upwards of two thousand years have elapsed, and still the fragments of that once predominant European branch of the human family linger on the western confines of Europe, preserving to us their ancient tongue, so invaluable for all the investigations of the ethnologist; but assuredly their days are numbered, the hold of twenty centuries is at length giving way, and it seems probable that, ere many more generations have passed, the living languages of the Kymri and the Gael will exist only, like the Cornish, in grammars and vocabularies of the philologist, and in the surviving fragments of their ancient literature.

The stock by which the ancient Keltæ of Europe have been displaced, and the classic nations superseded, is the Germanic or so-called Teutonic group, of which our own Anglo-Saxon race is the most powerful and widely diffused of all its members. The intrusion of the Germanic stock into Europe lies beyond the assigned dates of ancient history; but many indications serve to show, that while the Keltic races only obtrude upon the historic arena in their decline, like some long-voyaging ship seen for the first time as it dashes amid the breakers of a strange and rock-bound coast, the Germanic races dawn upon us in their young barbarian strength, with all their national being still awaiting its developement, and with the geographical arena of their historical existence occupied by the precursors whom they came to displace. Assuming, as a general rule, the uniform north-western progression of European population from the Asiatic cradle-land of the human race, to which science, no less than revelation, points, we are thence led to assign a certain relative age to races from their geographical position. In the extreme north are still found the Ugrian Fins and Laps, pertaining to a stock whose congeners abound in Asia and find their modern European representatives in the intrusive Majiars of Hungary, but who, as an ancient European stock, appear as the probable representatives of those Allophyliæ, whose existence in the north of Europe and in Britain, in periods prior to all written history, is now generally accepted as an established truth. In like manner, the mountainous Basque region of the Pyrenees shelters the last remnant of the ancient Iberian stock, an unclassed, if not aboriginal Allophylian race; while, among the mountains of Albania —like waifs caught in the eddy of the great western stream of population—are still found the Skipetar, another unclassed race, who, for ought that can be said to the contrary, may as truly represent to us the aboriginal Pelasgi of Greece, as the Basques undoubtedly do the Ibéri of Spain. Leaving those, and coming down in point of time to the Indo-European historic races, we find the Gaelic Kelts in the extreme north-west, as in North Britain and Ireland, and in Gaul, with the Kymric and other Kelts, as the Welsh of England, and the Cimbri and even the Teutones* of the northern shores of the European mainland,

* The science of Ethnology is still so much in its infancy, that it will least surprise the most zealous of its students to find its longest accepted terms called in question. Dr. Latham has advanced reasons in his "Ethnology of Europe," for believing that, "instead of the ancient Kelts of Iberia having been Kelts in the modern sense of the word, the Kelts of Gallia were Iberians," *i. e.*, were a different race from the Gauls north of the Garonne. Next to the term *Celtic*, no word is better established among English, though not among continental ethnologists, than *Teutonic*, as equivalent to Germanic, and thereby contra-distinguished from Keltic. The term, however, is at best arbitrary, at worst altogether false; for it is by no means improbable that the Teutones were Keltic, as it is certain that the evidence of Appian tends to show that both they and the Kỳmbri were of Gallic origin. (Vide Latham's "Germania of Tacitus," pp. cx., clx., clxiv.) The names *Teutones* and *Teutoni* have been mistakenly assumed as derived from the German *deutsch*, *teut-sch=teut-oni*. But the word signifying people, from which *deutsch* is derived, is either written *thiud*, Anglo-Saxon *theod*, or *diut*; never *thiut*, or *theut*, still less *teut*. *Teut*, on the contrary, appears to be a Gallic syllable. We find, among the Gauls, Teutomatus (Cæs. b. 7), Teutates (Lucan), Teutomalus (Liv. epist.). One of the Teuton chiefs was called Teutobochus or Teutobodus (Florus and Eutropius), while Pliny (v. 32) speaks of a Galatic people: Teutobodiaci. Another of the captive Teuton chiefs is named by Plutarch, Boiorix; while Livy (34, 46) names a Boiorix of a "Regulus" among the Galli Insubres in Upper Italy. There was a weapon peculiar to the Teutons, called *cateja* (vide Virgil, b. 7, Teutonico ritu soliti vibrare cateias), which Isidor calls *Genus Gallici teli*: the termination *eja* being strictly Gallic. Among the Belgs were the Aduatici, whose name is purely Keltic, and even recalls that of the Atacotti in Britain; but these Aduatici were, according to Cæsar, descendants of the Cimbri and Teutoni. Old Festus (de signif. verborum) says that the Ambrones who followed the Teutoni, were *gens Gallica*.

all occupying the geographical positions to which the foremost intruders into the European area must have been driven by the accession of successive migrations from the east. In Greece and Italy were the Hellenic and Kelto-Italian successors of the Pelasgi, with, in the Italian peninsula, the intrusive Semitic race of the Rasena or Etruscans. In Spain were the Ibéri and Celtibéri, with also a small intrusive race: Phœnician or Punic; and those with the Phocian and Punic colonies of Masallia and the larger Mediterranean islands, constitute the population of Southern Europe, when the curtain first rises and reveals to us the great arena of the world's later civilization. To the north of this, our imperfect knowledge suffices to disclose the central area of the continent, lying between the Alps and the German Ocean, occupied, from the Atlantic to the head of the Adriatic, by the different branches of the Keltic stock, and thence eastward to the Euxine Sea, and along the valley of the Danube, by the Scytho-Sarmatian stock, including the whole Lithuanian and the first of the Slavonian populations, by whom so large a portion of their ancient area is still retained. Of these latter the Lettes are the most ancient: the Lithuanic being the likest of all the Indo-European tongues to the Sanskrit, the ancient sacred language of India.

As a broad ethnological sketch of the superficies of Europe at the dawn of authentic history, this is no baseless theory, but an outline of facts as well established as the nature of the imperfect evidence admits. But it will be seen that only a very slight extension of the old Ugrian area, such as is presupposed by the assumption of the Fins and Laps of Northern Europe constituting the remnant of a more widely diffused Allophylian stock, is requisite to occupy the whole of Europe, without the presence of a single branch of the Germanic stock in any of their later geographical areas. While, however, those various older races were gradually moving westward, ever pressed from behind by fresh swarms from the Asiatic hive, till the Gael overflowed from Gaul into Britain, northward into the Kimbric Chersonesus, and southward into Italy, the younger Germanic stock entering Europe by the only unguarded portal, between the southern spur of the Ural Mountains and the Caspian Sea, circa 500 v. 400 B.C. (?), found their way along the banks of the tributaries of the Vistula to the Baltic.

Besides the approach to Southern Europe by the Mediterranean, by means of which the isolated Semitic populations of Etruria, Gadir, and Tartessus, and the Phocian and other colonial off-shoots of south-eastern civilization, reached its north-western shores, there are only two passages, or at most three, open to the migratory wanderers from Asia to Europe. The most southern of these, which required the navigation of the Hellespont or the Thracian Bosphorus, may be supposed to have been the course pursued by the ancient Pelasgi, or some still older southern Allophyliæ, in times lying beyond all history. This road, however, we know was early closed by the occupation of the whole of Asia Minor by Phrygians, Lydians, Lycians, Phœnicians, and other civilized and warlike people, whose presence entirely precluded the approach of any migratory horde to the shores of the Propontis. Beyond this, therefore, later migratory tribes, including, perhaps, the earliest pioneers of Keltic colonization, would find open for them the narrow passage formed by the lower valleys between the Caucasus and the Caspian Sea, and then reaching the northern shores of the Kimmerian Bosphorus, they would enter by the passage between the Carpathian Mountains and the Euxine into the fertile valley of the Danube. This road, also, in itself narrow and straightened, was closed against such nomade intruders long prior to the dawn of history, by the occupation of the whole country around the lower Danube by Scythic tribes belonging to the Thracian division. These warlike tribes were in undisputed possession of this important European area when we obtain our first glimpse of them in the pages of Homer, and no doubt can be entertained of their ability to withstand the encroachments of all later intruders.

Thus, then, at the assumed period of the immigration of the Germanic nomades, after the entire occupation of southern and central Europe by older races, there remained only one road open for tribes immigrating westward from Asia into Europe, through the Ural passage to the north of the Caspian Sea; and thence—the southern road through the valley of the Danube being now closed—they must have crossed the vast prairies of Russia, along the northern edge of the impenetrable forests of Volhynia and Poland, and the watershed of the Dnieper and the Vistula—the route pursued by the Huns, under Attila, in the fifth century—and thence along the tributaries of the Vistula to the Baltic. Here the ethnologist may be said to strike the trail of the first Germanic nomades. The later Cimbri or Kymri, and the younger Scytho-Sarmatians in their wake, having been obliged to pursue a north-western course till they reached the southern shores of the Baltic, the Kymri, and no doubt also the Belgæ, penetrated still further to the westward, while their Scytho-Sarmatian followers remained at the Vistula. The Germanic nomades, beginning their intrusive migration long after their precursors had consolidated their power, and occupied their borders with the increased numbers of a settled population, were compelled to pursue the still more northern, but less encumbered course, while being, in the common movement towards the west, driven to the shores of the Baltic near Livonia and Esthonia, they crossed to the Islands, to Gottland, Oland, and to Scania, and there settling themselves in the great northern Scandinavian peninsula, where archaeological research proves them to have displaced an older Allophylian population, they nursed their young strength, preparatory to their intrusion on the historic area of ancient Europe.

Archaeological investigations contribute many valuable accessories to such ethnological inquiries, and specially tend to confirm the conclusions here advanced relative to the late arrival of the Germanic nomades in Western Europe. This is strikingly shown by the abrupt transition from the aboriginal stone relics to the evidences of the metallurgic arts of the last Pagan period, disclosed in the sepulchral depositories of Northern Scandinavia.*

The Kymbri themselves were anciently known as *Galli*. The oldest author mentioning them is Sallust (Bell. Jugurth., c. 114, adversorum Gallos ab ducibus nostris Q. Cœpioni et M. Manlio male pugnatum est); also the Kimbric slave sent to kill Marius at Mintuone is called *natione Gallus* by Livy (Epist. 77). The latter notices tend to show that the assertion of Strabo, or rather Posidonius. (Strabo 7), afterwards repeated by Plutarch (Marius c. 11), that the Cimbri and Cimmerii are the same, is not one to be hastily rejected, though so able and cautious an authority as Dr. Latham has expressed himself as "utterly disbelieving the Cimmerii of the Cimmerian Bosphorus to have been Keltic." (Man and his Migrations, p. 169.) The above argument is chiefly designed, however, to justify the substitution of the term *Germanic* for that of *Teutonic*, employed by me elsewhere, and generally used in England to designate the Scandinavo-German race. Even if the Teutons can be shown to be Germanic, they were always a comparatively small and unimportant tribe, nor is the suitableness of the denomination *Germanic* disputed by any one; the supposed risk of confusion with it, in its modern political sense, has alone interfered with its adoption.

* Vide Prehistoric Annals of Scotland, p. 358.

Having established the Germanic nomades as a settled people in the northern peninsula still occupied by one great branch of the Germanic stock, the course pursued by them when they in turn became the aggressors is abundantly manifest, even now, on the map of Europe. Passing over into Denmark, and to a great extent displacing and dispossessing the Kymri, they entered Central Europe from that *point d'appui*, penetrating like a wedge between the Gauls and the Sarmatians, and gradually occupying the whole modern Germanic area between the Elbe and the Rhine. This is the movement which I conceive manifested itself by that overflowing of the Gauls into Central Italy, by means of which they, and thus also, indirectly, the Germanic aggressors on their rear, began, for the first time, to take their part in the great drama of the nations. Then it was that the Gallic population, pressed on from the north-east and confined on the west by the Atlantic, passed over into Britain: not, indeed, occupying it for the first time with a Keltic population, but intruding upon the older Keltic occupants, the Gallic Cantii, Belgæ, and others of those newer southern tribes, whose sympathy with their continental brethren first exposed their country to the aggressive arms of Rome. Few questions in ancient ethnology have been more keenly disputed than the Germanic or Keltic character of the Belgæ of Picardy; but nearly all ethnologists now agree in assuming that the Belgæ of Britain came from Belgic Gaul, and in the opinion that the continental Belgæ were Kelts. These points being assumed, all that we learn of the Belgæ from Cæsar—their warlike hardihood in maintaining the passes of the Rhine, the diversity of their dialect from the older Gauls, and the union and consanguinity recognized among themselves (Cæs. Bell. Gall., XI., 4)—confirm the idea of their recent migration from the eastern shores of the Rhine, and the consequent recentness of the Germanic intrusion of which this was a product.

The same great Germanic migration from the north into the centre of Europe, pressing southward, drove a part of the intercepted Keltæ to seek an outlet down the valley of the Danube, encountering in that fertile region Illyrian and Thracian occupants, and mingling with or displacing them in that rich country, the fertility and many natural advantages of which have so often contributed to make it the theatre of contending claimants. This may account for the two names, Danube and Iser: the former the Keltic name, afterwards adopted by the Romans, while the latter was accepted by the Greeks. When Alexander the Great, in 335 B.C., moved against the Thracians, he found the Kelts already settled to the east of the Adriatic, and received offers of alliance from them, not as a recent band of strange intruders, but as the proud and ambitious aggressors, who, at a later period, under Brennus, invaded Macedonia and Ætolia, and even attacked the holy Delphic shrine. The Keltic tribes, thus cut off from the great stock, and compelled to retrace their course, not only penetrated eastward, as we have seen, into Thrace, but passed over into Asia Minor, where they peopled Galatia; while, if we hold to the true Kelticity of the Keltic element of the Celtibéri of Spain, we may account for a similar overflow of the Gallic Kelts into the Iberian peninsula.

Thus we have the non-Indo-Germanic Phœnician, Punic, Etruscan, and other Semitic elements, passing by the southernmost route, from the shores of the Levant, into Southern Europe, and consequently not diffused as from a common centre, but occupying isolated and widely scattered positions. The oldest branch of the great Indo-European family of nations, the Gallic Kelts, follows by the southern land passage, preceding the classic races, and contributing to them a large portion of the philological elements by which they are known to us. How far they may also have contributed to their ethnological elements is uncertain. Whence, indeed, the Hellenic stock is derived is still a problem scarcely yet attempted to be solved. Was it derived from Italy to Greece, as Dr. Latham inclines, not without reason, to believe (Ethnol. of Europe, p. 97), or from Greece to Italy? Was it the product of an intermixture of Keltic and Pelasgic blood, or of Pelasgo-Keltic and Semitic blood? Intermixture of blood, not purity of race, seems the law of highest development in the historic races; and hence, perhaps, it is that the old Keltic migration moved on westward and diffused itself over the great central area of transalpine Europe through long unrecorded centuries, only making itself known by the shock with which it was rent in pieces when it came into collision with the younger historic races. Behind these Kelts came the Scytho-Sarmatian stock, still occupying to a great extent its original European area, though taking up so small and insignificant a section of the historic page; while the younger Germanic stock, Esau-like, seizing the birthright and the portion of the elder, has overstepped it in the race, preoccupied the area of the displaced Kelts, shared in the spoils, and borne a prominent part in the reinvigoration of Southern Europe; and now entering on the possession of this vast continent of America, and of that other new world which lies sheltered in the temperate zone of the southern hemisphere, the Germanic—or as we too limitedly designate it, the Anglo-Saxon—race is entering on fresh aggressions and claiming a wider theatre for the arena of its triumphs. Whether the stirring among the Lithuanic and Slavonic races of Eastern Europe, which now thrills us with the rumours of war, and shakes all Europe with the coming struggle, be any symptom of the long dormant energies of her Scytho-Sarmatian stock awaking at length to assert the claims of a long-proscribed priority of birthright, is a question which had attracted the notice of Panslavic students of ethnology before it forced itself on the attention of European diplomatists.

On some New Genera and Species of Cystidea from the Trenton Limestone.

Read before the Canadian Institute, February 11th, by E. Billings, *Barrister-at-Law, Bytown, Canada West.*

(*Concluded from page* 218.)

We pass now to the examination of one of the most extraordinary organisms yet discovered in the palæozoic rocks. It is no doubt a true Cystidean, but differing in one remarkable particular widely from any hitherto described. It has an oval or heart-shaped body, the broad base of which rests upon the usual short tapering stem of the group, while from its pointed upper extremity arise two long, slender, flexible arms or tentacula. One side is regularly formed of large plates, like those of the genus *Hemicosmites*, but the other is almost entirely occupied by an immense opening that extends from near the top quite to the base, and which appears to have been covered only by an integument, strengthened by small angular plates in a manner similar to the protection drawn over the cup in certain species of the Crinoidea.* It is constructed as if one side of a Cystidean had been cut away and removed, and the upper part of an encrinite placed in the space thus made vacant. In several specimens, although the integument has long since disappeared, yet the small plates still remain, occupying the cavity. In one species they are exceed-

* See Miller's description of the plated integument of *Pentacrinus caput Medusæ*, in the Natural History of the Crinoidea, p. 53.

ingly small, and more than a thousand in number, while in another they are much larger, and only about forty of them. In the Cystidea, as also in the Crinoidea, the part resting upon the column is considered to be the dorsal pole, and the upper part of the cup the ventral; but in this singular fossil the ventral region appears to have been displaced from its normal position, and drawn down, as it were, to one side, until it reaches the top of the column. This is not a deformity of a single individual, but as it is seen in all the specimens (clearly constituting several species), it must be regarded as a permanent character of the genus.

It must have been nearly flat, one of the broadsides being regularly formed of large plates, and the other covered by the integument. The former may be called the back, and the latter the ventral side. The following is the arrangement of the plates. See Figs. 9 and 10.

On the upper joint of the column rest four pelvic plates. Two of these are pentagonal, or hexagonal, and spread away from each other in the form of the capital letter Y, and in the angle thus formed is placed the large central hexagonal plate of the second series. The two other pelvic plates are situated one on each side, and partly under the former. They do not unite on the other side and form the cup-shaped pelvis of the ordinary Cystidea, but spread out, wing-like, from the sides of the column. Each sends out a slender projection at the bottom, which clasps round or rests upon the upper joint. Outside of these, again, are two other small plates, one upon each wing, making in all six in the basal series.

In the second range there are three large plates, one in the centre hexagonal, with a heptagonal plate on each side.

The third series contains four large plates, elongated vertically. One of these on the right hand of the centre is pentagonal, the other on the left hexagonal. They are narrowed above to correspond with the decreasing dimensions of the body, which here begins to contract. The other two plates of this row are either heptagonal or sligtly octagonal, and in their upper extremities they fold round the body, and unite on the other side by narrow projections, which arch over the great oval opening, as may be seen in Fig. 10. All those plates at the edge are folded under, so as to form a border round the ventral region on the other side. Above these are ten smaller plates, which close the summit, and form a solid support for the arms.

These arms are each formed of a series of double joints. When viewed from the rear, as in Fig. 9, or from the front, as in Fig. 10, these joints appear each to be formed of a single piece; but when seen from the outside, as in Fig. 11, they are double. On the inside, a double row of minute projecting tooth-like ossicula follows the suture down each arm, and crosses the summit between them. There is a figure on plate 2, opposite p. 51, in Miller's Natural History of the Crinoidea, which shows six fingers of *Pentacrinus caput Medusæ* attached to the hand, four on one side, and two on the other, which exactly resemble the arms of this species. There, too, it will be observed, a double row of ossicula run up the inside; and these appendages upon this Cystidean appear rather to be of the nature of tentacula than true Crinoidal arms.

The only apertures visible in the specimens yet procured are a small one immediately below the summit on the ventral side on the suture between two small plates, and another at the base, on the right side of the pedicle (Fig. 10), where the border round the great oval opening is excavated into a channel for the passage of what appears to have been a proboscis of small plates. Between the arms, the rows of ossicles which fringe the inside cross from base to base, and it may be that at this point they form a valvular apparatus above the mouth, as in the last species. If this be so, then the orifice immediately below is without doubt an excretory aperture, and the other at the bottom may be regarded as ovarian.

There are three pectinated rhombs, one at the base, half of which is situated on the right pelvic plate, and the other half on the central hexagonal plate of the second series. The other two are situated, one on the left pair of plates in the third series, the other on the right. They are entirely open—that is, the elongated pores cross from one side of the rhomb to the other at right angles to the suture, without being concealed by an unperforated space in the centre, as in *Glyptocystites*. When the rhombs of the latter are ground down, as before mentioned, they are then open, as in the present genus.

As this strange inhabitant of the old Silurian ocean consisted, properly speaking, of but one side, constructed on the normal pattern of the Cystidea, I propose, as a name for the genus, *Pleurocystites*, from the Greek Κυστις and πλευρον. There are clearly several species, but I shall only recognise three at present.

Pleurocystites squamosus.

Fig. 9. Fig. 10. Fig. 11. Fig. 12.

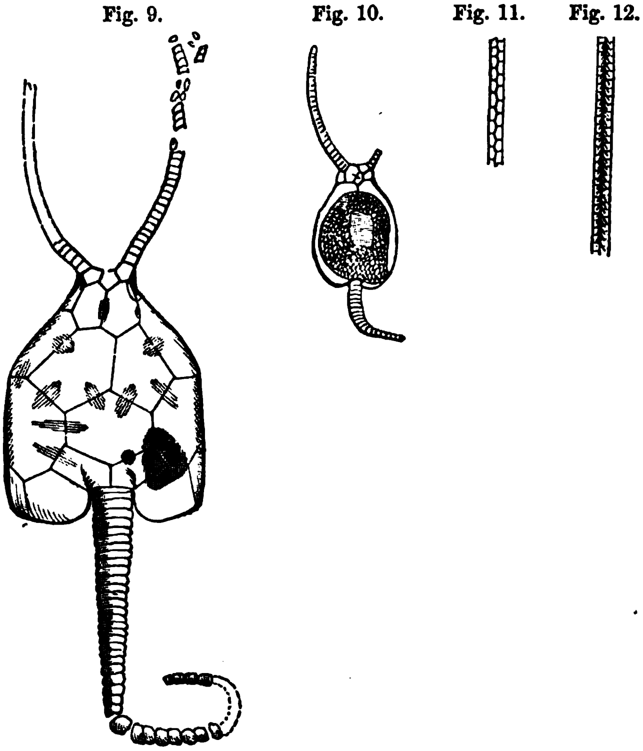


Fig. 9. *Dorsal view of a large specimen.*
" 10. *Ventral view of a small do.*
" 11. *Outside of arm, showing the double joints.*
" 12. *Inside of do., showing the rows of ossicula.*

In this species the rhombs are small in proportion to the size of the body, and of an oval shape, the greater axis of the ellipse crossing the sutures between the pairs of plates upon which they are situated at right angles. The integument is composed of a vast number, more than a thousand, minute, scale-like plates, mostly hexagonal, and less than the fiftieth part of an inch in

diameter. The surfaces of the large plates appear to have been nearly smooth, or only obscurely striated; but as the specimens are much worn, this appearance may be deceptive. These are the only specific characters that can be given at present.

Pleurocystites filitextus.

Fig. 13. Fig. 14.

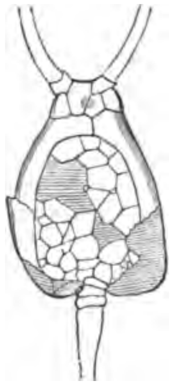


Fig. 13. *Ventral aspect of an imperfect specimen.*
" 14. *The left rhomb alone.*

The rhombs of this beautiful species are lozenge-shaped, with straight sides and sharp angles. They are much larger than those of *Pleurocystites squamosus*, and situated perpendicularly —that is, the longest diagonal of the rhomb extends up and down, and the shortest lies across the fossil. The reverse of this is the order in which they are disposed in the other two species. In all the species, it should be here observed, the left rhomb above is the largest. Fig. 14 is the left rhomb of a specimen of the size figured in 13. All the large plates on the dorsal side have strong rounded ridges radiating from the centres to the corners, and smaller ones between them, which cross the lines of division between the plates at right angles from centre to centre. These are again crossed by lines of growth parallel with the edges, producing a beautiful woven effect. Hence the specific name. The integument consists of about forty angular plates of various sizes. These characters separate this species from the other in a very marked manner. In one locality there are great numbers of the plates and disjointed columns of this species, and it was there that the specimen Fig. 13 was found. It is separated from the matrix, but although the back exhibits one rhomb and the character of the striation, yet it is otherwise so much distorted that a figure of it would convey but little instruction. I have not been able to ascertain clearly the size o the other two rhombs.

Pleurocystites robustus.

Fig. 15.

Of this species I have only the fragment here figured, but it is so widely different from the others, that there can be little doubt of its being distinct. The rhombs are nearly in the shape of a spherical triangle, one side crossing the suture above and one of the angles being upon it below. Here, too, the left one is the largest. They are excavated into a deep hollow with a rounded bottom, the longer axis lying across the fossil. They are also surrounded with an elevated border. The plates near the edges are marked with fine striæ at right angles to the sides, but the ridges proceeding to the corners are barely perceptible. There are also several faintly-perceived crenulations parallel to the edges. An elongated tumour lies between the right rhomb and the vertical suture in the centre. Altogether, this is a more vigorous species than either of the two former.

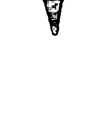
Besides these, there are several specimens exhibiting only the back, but very perfect, which will constitute either one or two other species. Until the other side can be seen, they can hardly be classified as one, and yet they are clearly distinct from the above. It is only within the last four months that specimens were discovered showing the structure of the ventral side of this genus, and since then there has not been time to study them minutely. It may be that an aperture will yet be found situated somewhere in the integument near the centre, but at present appearances are against it.

These are all the Cystidæ in my possession with poriferous areas clearly developed, and which have been found in a sufficient state of perfection to admit of their being described; but there are detached plates frequently found here in the upper layers of the Trenton limestone, which exhibit the remains of these organs of a form different from any of the above. They prove nothing, however, more than the fact that other species of Cystidea are imbedded in the formation. There are seven other species, of which I have some very good specimens, which differ widely from *Glyptocystites* and *Pleurocystites*, and of these I shall probably prepare another paper before the end of the session. They are without poriferous areas, and some of them approach the Spheronites in form, but are furnished with fimbriated arms.

It may be proper here also to notice a remarkable Crinoid, which conspicuously displays upon its surface upwards of twenty small sub-triangular spaces perforated with elongated pores, resembling those of the rhombs of the Cystidæ. The cup is small and conical, composed of three rows of plates. The first series, or pelvis, consists of five pentagonal pieces, the second series of five, four of them hexagonal and one heptagonal, alternating with those below. The scapulæ are also five, and of a heptagonal shape. They alternate with the second series. On one side, between two of the scapulæ, there are either one, two, or three small plates; but owing to the circumstance that all the specimens (four in number) happen to be badly preserved or mutilated at this point, they cannot be ascertained.

These poriferous areas are each formed of the three angles of three contiguous plates. From the point of each plate a pore extends towards the centre, and all the others on that plate are parallel to this central pore. In each area, therefore, they run in three directions, and are not at right angles to the sutures between the plates, as in the Cystidea. Figs. 16 and 17 will explain this arrangement with greater clearness than a written description.

Fig. 16. Fig. 17.



They are thus situated:

On the apices of the pelvic plates	5
At the upper extremities of the upright sutures between the plates of the second series	5
On the upper angles of the second series	5
Between the arms	5
	20

There are thus twenty placed at the angles of the principal plates; but besides these, there are also several small ones among the supplementary plates on one side above mentioned.

Eclipse of the Sun, May 26th, 1854.

Extract from the Minutes of the Council of the Canadian Institute.

"*Resolved*, That Professors Cherriman and Irving be appointed a Committee to draw up instructions for general distribution relative to the approaching solar eclipse."

Report of the Committee appointed by the Council of the Canadian Institute to draw up suggestions for observers of the Eclipse of the Sun on May 26th.

The following recommendations are submitted by the committee appointed by the Council of the Canadian Institute to draw up suggestions for observers of the approaching eclipse of the sun on May 26th. These suggestions are not intended to be addressed to professed astronomers, but to those who, feeling an interest in such subjects, would gladly have those circumstances pointed out on which they should fix their attention, as giving them the means of increasing the recorded data, or as likely to be of special interest to themselves.

The eclipse being, under the most favorable circumstances, only annular, the peculiar phenomena of a total eclipse will not be seen, viz., the corona, and the rose-colored flames or prominences. The corona is never seen till an instant or two after the total obscuration has begun. It is a ring of light, or halo, surrounding the sun, within which have generally been seen certain red flames, as it were bursting out from the side of the moon, very variable both in shape and size. Of these latter we cannot expect to see anything during the approaching eclipse, nor of the corona directly. Indirectly, however, we may probably meet with proof of its existence, and that in a way which will tend to confirm the theory of its appearance; which is this—The sun is supposed to be surrounded by an atmosphere like our own, non-luminous but capable of reflecting light, which would produce to us the same appearance as if the sun's disc were surrounded by a faintly luminous ring. In consequence, however, of the general brightness of the sky produced by the dispersion of the sun's direct light by our own atmosphere, this ring is not generally visible. In a total eclipse, the brightness of the sky is so far reduced in the immediate neighbourhood of the sun that the ring becomes visible, and constitutes the corona. In a partial eclipse the sky is still too bright to admit of our seeing this ring as a corona, but its illumination is strong enough to render visible the part of the moon exterior to the sun's disc as a dark body on a bright ground, the part nearer the sun's edge being more distinctly seen than that more remote. This is in accordance with observations which have been already made; and it will, therefore, be an object of interest to look for the portion of the moon's disc exterior to that of the sun. It will probably be visible when about half the sun's diameter is obscured, and may be seen through an ordinary telescope, provided the lenses are well polished and perfectly clean.

The following are the observations which it will be advisable to make during the progress of the approaching eclipse.

These observations may be conveniently divided into

I. Observations requiring instruments.

II. Observations which may be made without instruments.

I. The observations requiring instruments may be again subdivided into two classes, which we may call Astronomical and Physical.

The observations under the first class will be as follows:—

Note the duration of the eclipse by ascertaining the exact moment of the beginning and end, as denoted by a watch. These epochs will be of no use in themselves, unless the watch's error and rate have been accurately determined; but if the watch be a pretty good one, the difference between the epochs will give, with tolerable accuracy, the duration of the eclipse. At places where the eclipse is annular, there will be four epochs to be noted—the times of the two external contacts, as in the case of the partial eclipse, and also the times of the two internal contacts, corresponding to the beginning and end of the annularity. To ascertain these times with any accuracy, there must be two observers—one holding the watch and keeping his eyes fixed upon the seconds-hand; the other looking at the point of the sun where the contact is expected. The signal should be given sharply, by a single syllable. This observation may be made without a telescope, but better with one. With a sextant, where the eclipse is partial, the distance between the cusps may be repeatedly measured about the time of the greatest obscuration; and where the eclipse is annular, several measures of the breadth of the annulus may be made in its narrowest part: in both cases noting the time of each observation. It will also be interesting to obtain a measure of the moon's apparent diameter, where the eclipse is annular. In consequence of the irradiation of the sun's light, the measure thus obtained may be expected to be less than the calculated apparent diameter.

The following are the points to which an observer who has the opportunity of using a telescope should especially direct his attention. An ordinary telescope will be sufficient for these purposes, provided that it is fitted with coloured glasses of various shades to enable the eye to bear the sun's light.

1. The serrated or jagged edge of the moon's disc may be seen with a low magnifying power, as she moves over the sun's face.

2. When about half the sun's diameter is eclipsed, the observer should carefully endeavour to detect the portion of the moon's disc exterior to the sun; and he should especially notice whether that portion of the external surface of the moon which is close to the sun is seen with sensibly greater distinctness than parts at a greater distance. It may be well here to repeat the warning, that there will be no chance of this observation being successfully made, unless the lenses of the telescope are well cleaned.

3. The cusps should be attentively watched, in order to ascertain whether they remain sharp and well defined, or whether at any time they become blunted or irregular.

4. Where the eclipse is annular, the phenomena known as "Bailey's beads" may be looked for. When the western limb of the moon is leaving the western limb of the sun, it appears

serrated or jagged, the light of the sun shining between the teeth. These teeth or projections appear to increase in size, and to diminish in number, until on some occasions the two discs have been seen united only by broad, well-defined dark threads, which at last disappear instantaneously. The same phenomena recur in an inverse order as the eastern limb of the moon approaches the eastern limb of the sun. It should, however, be noticed that the threads above mentioned are considered by Arago to have been optical delusions, arising from the axis of the telescope not having been properly pointed.

In the second class of observations are included the changes occurring in the intensity and quality of the sun's light and heat, and the atmospheric or terrestrial phenomena produced thereby.

Observations should be made continuously throughout the eclipse with the ordinary psychrometer, or wet and dry bulb thermometers, in the shade; and, in the absence of an actinometer to measure the intensity of heat produced by the sun's rays, valuable information will be given by a common thermometer with a blackened bulb (a coating of lamp-black will serve) fully exposed to the sun's rays, and protected as much as possible from reflection of heat from any neighbouring buildings or substances.

It would be desirable to obtain some measure of the variation in the intensity of the sun's light; but no plan has yet been devised for doing this; the methods rudely practicable in a total eclipse will be here of little avail.

Changes in the quality of the light should be noted by observation of the solar spectrum formed by refraction through a prism, examining whether any of the colours seem more changed in intensity than others, and whether the red end of the spectrum appears to increase; also, if the prism be capable of showing the dark lines, whether they undergo any modifications either in number or position. It would also be interesting to take photographic copies of the spectrum at different stages of the eclipse, to detect any variation in the actino-chemical rays. If the observer be provided with a polariscope or a Nichol's prism, he should examine the polarisation of the light at different points of the sun's disc.

II. One observer should also confine his attention to phenomena which do not require instruments for their observation.

Among these, the most important will be to note if any change be perceptible, about the period of the greatest obscuration, in the aspect of terrestrial objects, and especially in the colour of the sky near the horizon in the part opposite to the sun: to observe whether a well-defined shadow of a staff or cross thrown on a wall be subject to any flickering motion, especially about the edges; and whether any moving bands or patches of light are seen to traverse the wall or ground; also, whether the shadow of the moon can be detected "sweeping through the air," as described by Mr. Airy in the last total eclipse.

Another observer should confine his attention at this period to the sun itself; examining how the intensity of the light varies in different directions round the disc; whether there are beams of light, or the rudiments of a ring round the moon; and whether there is any light on the side opposite to the bright lune.

In the event of a light cloud or haze crossing the sun, the observer should watch for any manifestation of coronæ or coloured rings, noting their colours and approximate diameters. They will be most easily seen by reflection in water, or by the use of a light brown glass.

It is not to be expected that the effects described as produced on the animal and vegetable creation by the entire deprivation of the sun's light in a total eclipse will be at all noticeable in the present case, nor that stars will be visible to the naked eye. It is, however, possible that the planet Mars may be caught sight of, about 90° to the east of the sun.

In conclusion, observers should be warned against attempting too much. The period of the greatest obscuration only extending over three or four minutes, it is impossible for a single observer to note all the phenomena that occur. The best way will be for several persons to agree beforehand on the points to which the attention of each shall be exclusively directed, and from which no temptation should be suffered to distract him.

As a rough guide to the circumstances of the eclipse at different places in Canada, it may be remarked that a line drawn on a map from Ogdensburgh to Isle Royale, on Lake Superior, will pass through those places at which the eclipse will be central. Lines parallel to this drawn through the south-western extremity of the Island of Montreal and through Kingston will be respectively the northern and southern boundaries of the annularity. Parallel lines through Toronto and Quebec will approximately determine those places at which eleven digits will be eclipsed at the greatest obscuration.

The times of the beginning of the eclipse will be, at Toronto, $3^h\ 44^m{\cdot}7$; at Kingston, $3^h\ 57^m$; at Ogdensburgh, $4^h\ 2^m{\cdot}7$; at Montreal, $4^h\ 11^m{\cdot}3$: at Quebec, $4^h\ 19^m$, the angle of contact being about 150° from the north point toward the west. The duration of the eclipse will be nearly two hours and a half.

In order that observations made in accordance with the above suggestions may be presented in a combined form to the Institute, it is requested that any communications on the subject be addressed to the Director of the Magnetic Observatory, Toronto.

INCORPORATED BY ROYAL CHARTER.

Fifteenth Ordinary Meeting, April 1st, 1854.

The following gentlemen were elected members:

J. S. Walker	Brantford.
T. Maclear	Toronto.
H. Piper	"

A paper was read by Professor Wilson on the following subject: "Some remarks on the intrusion of the Germanic races into the area of the older Keltic races of Europe."

Sixteenth Ordinary Meeting, April 8th, 1854.

The names of the following candidates for membership were read:

Thomas Keefer, C.E. .... Montreal.
Andrew Hood, P.L.S. .... Dunville.

A second paper by Elkanah Billings, Barrister-at-Law, of Bytown, C.W., "On some new Genera and Species of Cystidea from the Trenton Limestone," was read.

The President announced that the concluding meeting of the Institute for the Session 1853-4, would be held on Saturday, 29th April.

Seventeenth Ordinary Meeting, April 29th, 1854.

The following gentlemen were elected members:

Thomas Keefer, C.E. .... Montreal.
Andrew Wood, P.L.S. .... Dunnville.

The name of the following candidate for membership was read:

James Farley .... St. Thomas.

The Rev. John McCaul, L.L.D., President of University College, delivered an eloquent and learned Lecture on "Some doubtful points of Grecian and Roman Antiquities."

A very interesting and elaborate paper "On the Rise and Fall of the great Lakes," by Major R. Lachlan, of Montreal, was read by the Rev. Professor Irving.

The President announced that on Saturday, May 6th, a General Meeting would be held to take into consideration the Report of the Committee appointed by the Council to make final arrangements for the union of the Toronto Athenæum with the Canadian Institute.

Sykes' Steam Hammer.

We publish this month an engraving of a very ingenious arrangement of a steam-hammer, which has been invented and patented by Mr. Sykes, Superintendent of the Toronto Locomotive Works.

This hammer is not proposed to equal in the range of its application the steam-hammer invented by Nasmyth, but it accomplishes in a much cheaper and more simple form many of the objects attained by that patent.

The chief advantages of this arrangement are: first, the direct application of the steam without the intervention of a steam-engine, and its consequent fly-wheels, belts, and gearing; secondly, the arrangement of the steam valves in such a form as to admit of a perfect adjustment of the height of the stroke and the vigour of the blow given. This adjustment is not perhaps quite so perfect as that of Nasmyth's, but it is sufficient for all practical purposes. As compared with Nasmyth's, its disadvantages are that it does not give a square or parallel blow, and the forging of square work must therefore partake of the angularity of the face of the anvil to that of the hammer in proportion to its thickness, unless the hammer head is changed with each change in the dimensions of the work to be done. This, however, is only true in the case of work requiring parallel faces, and does not affect the forging of shafts or other round work. The nature of this arrangement also prevents its application on so large a scale as in Nasmyth's hammer. For ordinary work, however, and for shafts which do not exceed ten or twelve inches in diameter, the small cost of this hammer will, we think, be sufficient to ensure its extensive use.

LITERAL REFERENCES.

A—Anvil block.
B—Hammer head. These may be of such form as is desirable for swaging the work to the required form.
C—A spring of flexible timber against which the hammer head strikes in its upward stroke, and is intended to overcome the momentum of the hammer, which would otherwise throw the piston out of the stuffing-box.
D—A cast-iron socket which carries the hammer arm, the centre *O* on which it oscillates, and the piston.
E—The piston made square and concentric with the centre *O*, and can be completely finished in the lathe.
F—Is the steam-chest in which the piston works, being furnished with a stuffing-box and gland of the ordinary construction.
a—Valve-chest, containing double slide valves, the adjustment of which in relation to each other regulates the stroke of the hammer.
b—Valve-lever, the position of which on the arc *c* regulates the relative position of the valves.
d—The under valve rod.
e—Exhaust-pipe for waste steam.
f—Lever attached to the main centre *O*, by which the oscillations of the shaft communicate the requisite motion to the upper slide-valve by acting on studs placed in the proper position on the valve-spindle *g*.
s—Steam pipe.
G—Main centre frame of metal.
H—Foundation plate.
K—Foundation of timber or stone.
t t—Iron columns by which the spring *C* is secured.

The Northern Railroad—Lake Ontario and Lake Simcoe.

On Saturday, May 6th, the Mayor and Corporation of the City of Toronto, the Sheriffs and Wardens of the Counties of Ontario and Simcoe, the Member for Simcoe, and a large number of private gentlemen, were invited by the President and Directors of the Northern Railroad to assist in celebrating the establishment of a daily communication, going and returning, between the City of Toronto and the shores of Lakes Simcoe and Couchiching.

The Northern road was in excellent condition, and the cars acquired a high degree of speed without the least disagreeable motion, placing the guests of the Directors by the side of a handsome and very commodious steamboat at Bell Ewart, on Lake Simcoe, in a little over two hours after leaving Toronto.

Shortly after the arrival of the party at Bell Ewart, the

steamer was under weigh for Orillia, on the shores of Lake Couchiching, where a stay of about an hour was made. Returning, the boat arrived at her destination some time before the cars appeared. The party reached Toronto a few minutes after 10 o'clock, p.m. It is needless to remark that every attention was paid by the Directors to the enjoyment of their guests. All arrangements were admirable, and cannot fail to secure for the delightful scenery of Lake Simcoe and Lake Couchiching many admirers during the coming summer.

Miscellaneous Intelligence.

DR. BARTH'S ARRIVAL AT TIMBUCTOO.

To the Editor of the Evening Mail.

SIR,—Despatches and private letters have this morning been received from Dr. Barth, announcing his safe arrival at that celebrated city, Timbuctoo.

In order not to encroach too greatly on your valuable space, the reader may be referred to the account of the expedition under Dr. Barth just published by authority of Her Majesty's Foreign Office, in which work all the reasons that prompted Dr. Barth to venture on that undertaking are explained, and the first portion of the journey itself is described. It suffices to observe that when Dr. Barth, in September, 1852, lost his only companion, Dr. Overweg, he saw himself reluctantly compelled to abandon for the time the contemplated journey across the continent towards the Indian Ocean. He resolved, however, with true heroism, to undertake alone the journey to Timbuctoo, which, though greatly less in magnitude than a journey would be to the Indian Ocean, was looked upon as a most difficult and dangerous attempt. "As the sole survivor of the mission [so wrote Dr. Barth before his departure from Kuka], the completion of its objects now devolving entirely on me, I feel my powers doubled, and my mind all the more determined, single-handed, to follow up the results already obtained. My means consist of a tolerable supply of presents, in addition to 200 dollars, four camels, and four horses. My health is in the best condition, and, with five trustworthy, long-tried servants, well armed, and having plenty of powder and shot with us, I shall, with fresh and redoubled courage, and with full confidence of success, start on my journey to Timbuctoo."

Accordingly, Dr. Barth, a man who never boasts with empty words, set out from Kuka by the end of November, 1852, and proceeded first to Sakata, by way of Zinder and Kashna, the route by Kano being impracticable, on account of the war in that region between the Bournouese and Fellatahs. The last letters received from him were dated Kashea, 6th of March, 1853; those received this day from Timbuctoo, by way of Tuat, bear dates ranging from the 7th of September to the 5th of October last, and none of the various letters despatched during the six months from March to September have as yet reached Europe. The details of his proceedings during that time, therefore, comprising the whole of his journey from Kashna to Timbuctoo, are yet unknown. It appears, however, that the general direction of his route from Sakatu to Timbuctoo was at first west-north-west, and that he crossed the Kowara (commonly called Niger) at Say, an important place, of considerable size, situated in about 14° north latitude and 3° 45′ east longitude, Greenwich, 150 geographical miles west-north-west from Sakatu. Both from this place and Libtako he had despatched letters to Europe by way of Sakatu. Libtako is a large place, situated in about 14° 40′ north latitude and 0° 30′ east longitude, 335 geographical miles from Sakatu, and 240 from Timbuctoo.

From Libtako to Timbuctoo, the general direction of Dr. Barth's course was north-west till he reached Saraiyamo, a large town 60 miles south of Timbuctoo, and situated on a tributary or branch of the Kowara. On the former river he embarked on the 1st of September. At first it presented a fine sheet of water, 300 yards in width, but afterwards a most intricate system of narrow meandering channels, partly overgrown with reeds and grass, at a distance of 40 miles in a straight line from Saraiyamo. After a very tedious zigzag navigation, he entered the main stream, the Kowara, on the 4th of September, near the village of Koromeh, presenting a magnificent aspect, covered, as it was, with a numerous fleet of vessels and boats of various sizes.

Crossing the Kowara, and entering a creek on its northern side, Dr. Barth reached Kábara on the next following day. Kábara is only a small town of 400 houses and huts, but has attained great celebrity as the port of Timbuctoo. It scarcely, however, deserves that distinction, as it is approachable by water only during four months of the year at an average, and at most during five months, when the floods are unusually high. The creek on which it is situated is of so inconsiderable a size and depth that even at the time of Dr. Barth's visit, which was during the rainy season, the boat, bearing only himself and his effects, had to be dragged up to the place with great difficulty; the creek measured about fifteen feet across, and the water scarcely reached up to the boatmen's knees. The docks of Kábara, as an artificial, large, handsome basin close to the town may be called, contained but a few boats at the time of Dr. Barth's arrival. Koromeh, the place already mentioned, and the islands of Day, between it and Kábara, have greater claims to be considered the port of Timbuctoo.

On the 7th of September, 1853, Dr. Barth entered the city of Timbuctoo in grand style, escorted by the brother of the Sheikh-el-Bakay, the ruling chief, and by a splendid suite on horseback, on camel and on foot, welcomed and saluted by the festive multitudes of the inhabitants. The latter had been made to believe that the arriving stranger was a messenger from the Great Sultan of Stamboul! The real character of Dr. Barth was only known to the Sheikh himself, whose protection and goodwill the intrepid traveller had been fortunate enough to obtain, and who considered it advisable that he should assume that character, on account of the very fanatical disposition of the great mass of the people. During Dr. Barth's subsequent stay, up to the 5th of October, the Sheikh-el-Bakay and his brother had remained the faithful friends of the pretended "ambassador from Stamboul;" but even under this character Dr. Barth considered himself not entirely free from danger, owing to the complicated nature of the political powers which exercise a sovereign sway over Timbuctoo, the inhabitants being composed of various nationalities. There are—first, the Sonray, forming the great mass of the people; then Arabs of various tribes—Fellatahs and Tuaricks, together with a small number of Bambara and Mandingo. One faction was not at all favorably disposed towards Dr. Barth, but wished his death; so that it was necessary for him to observe great caution in his movements and intercourse with the people. Fortunate, indeed, was it that the traveller had secured the sincere and unequivocal friendship of the Sheikh, under whose immediate protection he lived at his residence, and who had promised to have him safely escorted on his return to Sakatu.

Thus far the news will be gratifying to the friends of Dr. Barth. His state of health, however, was not in the same degree satisfactory. The accomplishment of the journey from Lake Tsad to Timbuctoo, which, in linear extent, taking into account the windings of the route, amounts to at least 2000 miles, may well prove a trying task for the physical powers of any man, from its extent alone; but when to this is added a preceding three years' travel and toil, the obstructions arising from the rainy season, with its swollen rivers, floods, and inundations, during which, partly at least, the journey to Timbuctoo was accomplished, together with the harassing difficulties and dangers arising from the fanatical character of the inhabitants he had to pass through, it will scarcely excite surprise that Dr. Barth should have reached Timbuctoo in a rather exhausted condition. Such were the exertions of the journey that two out of the six camels died on the road, and the remainder were unfit for further use. And as to Timbuctoo, the sojourn at that place seems to have been anything but refreshing and strengthening in its effects on Dr. Barth, consisting, as it does, of a pent-up mass of closely packed buildings. Attacks of fever, therefore, affected the health of the traveller still more than the weakening effects of the journey, and it is evident from the letters that his strength was greatly impaired when he wrote them. Hopes, however, of soon rallying and regaining his strength never left Dr. Barth, and with a most remarkable perseverance and courage he was planning his next journey, the return to Sakatu, while despatching the letters now received.

The city of Timbuctoo, which to reach has been the life's ambition of so many celebrated travellers, is placed by Dr. Barth in 18° 3′ 30″ to 18° 4′ 5″ north latitude, and 1° 45′ west longitude, Greenwich. Its form is that of a triangle; it is closely built of houses, mostly of clay and stone, many with handsome and tasteful fronts—the interior being similarly arranged to that of the houses in Agadez, visited by

Dr. Barth in 1850. The population is estimated at 20,000 souls. Dr. Barth found the market of Timbuctoo, celebrated as the centre of the North African caravan trade, of less extent than that of Kano, but the merchandise of superior quality and of greater value. He has obtained a complete *imana* from the Sheikh for any English traders who may wish to visit Timbuctoo. The country in which that city is situated borders on the Zahara, and is, indeed, similar to that region, being of a dry and barren description, except towards the Kowara, where it assumes a more fertile appearance. September formed the height of the rainy season, and the rains, though not heavy, occur every second or third day.

Dr. Barth hoped to leave Timbuctoo "within a month" from the 29th of September last, to return to Sakatu, and it is most probable that he will travel down the Kowara as far as the town of Say. He was not yet aware either of the succour under Dr. Vogel, despatched from this country in February, 1853, nor of the steamboat expedition now on the eve of departure for visiting the regions discovered by him in 1851; but it is sincerely hoped this cheering and encouraging news may have reached him soon after the despatch of his letters, and that, moreover, it may be his good fortune to fall in with either the one or the other.

Further communications, both from Dr. Barth and from Dr. Vogel, may now be expected with every mail.

The geographical importance of Dr. Barth's journey to Timbuctoo will not require to be pointed out; its accomplishment adds a fresh leaf to the laurels of that meritorious and distinguished traveller.

I have the honor to be, Sir,

Your most obedient humble servant,

AUGUSTUS PETERMANN.

9, Charing Cross, March 25.

Book Trade in the United States.

Of the octavo edition of the Modern British Essayists, there have been sold in five years not less than 80,000 volumes. Of Macaulay's Miscellanies, 3 vol. 12mo the sale has amounted to 60,000 volumes. Of Miss Aguilar's writings, the sale, in two years, has been 100,000 volumes. Of Murray's Enclopædia of Geography, more than 50,000 volumes have been sold, and of M'Culloch's Commercial Dictionary, 10,000 volumes. Of Alexander Smith's Poems, the sale, in a few months, has reached 10,000 copies. The sale of Mr. Thackeray's works in America is said to have been quadruple that in England,—and that of the works of Mr. Dickens counts almost by millions of volumes. Of Bleak House, in all its various forms—in newspapers, magazines and volumes—the sale has already amounted to several hundred thousands of copies. Of Bulwer's last novel, since it was completed, the sale is said to have exceeded 35,000. Of Thiers's French Revolution and Consulate, there have been sold 82,000, and of Montagu's edition of Lord Bacon's works 4,000 copies, Of American authors, the most popular—not excepting Mrs. Stowe—is Mr. Washington Irving;—and of all native works his has been the most widely circulated. Prior to the publication of the edition recently issued by Mr. Putnam, the sale has amounted to some hundreds of thousands; and yet of that edition, selling at $1 25 cents per volume, it has already amounted to 144,000 volumes. Of Uncle Tom, the sale has amounted to 295,000 copies, partly in one, and partly in two volumes, and the total number of volumes amounts probably to about 450,000. Of the two works of Miss Warner, Queechy, and the Wide, Wide World, the sale in America has been 104,000 volumes. The following may be also noted:—Fern Leaves, by Fanny Fern, in six months, 45,000; Reveries of a Bachelor, and other books, by Ik Marvel, 70,000; Alderbrook, by Fanny Forester, 3 vols. 33,000; Northup's Twelve Years a Slave, 20,000; Novels of Mrs. Hentz, in three years, 93,000; Major Jones's Courtship and Travels, 81,000; Salad for the Solitary, by a new author, in five months, 5,000; Headley's Napoleon and his Marshals, Washington and his Generals, and other works, 200,000; Stephen's Travels in Egypt and Greece, 80,000; Stephen's Travels in Yutacan and Central America, 60,000; Kendall's Expedition to Santa Fè, 40,000; Western Scenes, 14,000; Young's Science of Government, 12,000; Seward's Life of John Quincy Adams, 30,000; Frost's Pictorial History of the World, 3 vols. 60,000; Spark's American Biography, 25 vols. 100,000; Encyclopædia Americana, 14 vols. 280,000; Griswold's Poets and Prose Writers of America, 3 vols. 21,000; Barnes's Notes on the Gospels, Epistles, &c., 11 vols. 300,000; Aiken's Christian Minstrel, in two years, 40,000; Alexander on the Psalms, 3 vols. 10,000; Buist's Flower Garden Directory, 10,000; Cole on Fruit Trees, 18,000; Cole on Diseases of Domestic Animals, 34,000; Leslie's Cookery and Receipt Books, 96,000; Wood and Bache's Medical Dispensary, 60,000; Dunglison's Medical Writings, in all 10 vols. 50,000; Webster's Works, 6 vols. 46,800; Kent's Commentaries, 4 vols. 84,000. Such a list looks rather odd under the light of the misrepresentation that the Anglo-American enjoys no native-born literature, and relies on English writers for his intellectual nourishment.

Production of Oxygen Gas.

M. Boussingault has lately decribed a process by which pure oxygen gas may be obtained from the atmosphere at a trifling cost, so as to enable it to be collected in unlimited quantities, and preserved in gasometers, like coal gas, for application to many practical uses in the arts. This process depends upon a peculiar property possessed by the earth barytes, of absorbing the atmospheric oxygen at one temperature and evolving it at another; or rather, the ready conversion of hydrate of barytes into peroxide of barium, by a current of atmospheric air at a dull red heat, and the decomposition of the peroxide, by steam, at a lower temperature, even at 212 degrees F., with re-formation of the hydrate of barytes—the process being in reality a continuous one.

It is found in practice advisable to mix the barytes with hydrate of lime or magnesia, so as to prevent the fusing of the first; this mixture, when placed in an earthen tube heated to dull redness, is to be oxidized by passing a current of dry atmospheric air over it. So soon as the oxidation is completed, the tube is connected with the gas-holder, and a jet of steam allowed to act upon it; this re-converts the peroxide of barium into hydrate of barytes, the excess of oxygen being given off and collected in the gas-holder. The barytes is then again oxidized by a fresh current of air, and deoxidized by steam, as frequently as required, thus making the process continuous. M. Boussingault considers that about 1,000 cubic feet of pure oxygen gas could be obtained every twenty-four hours, by the use of 10 cwts. of barytes, which will answer this purpose for any length of time.

Sugar of Lead Refuse.

SIR: Having reason to believe, from what passed in conversation with a Chemist and a Fellow of the Royal Society, that the manufacturers of sugar of lead are not aware of the nature of a greyish powder produced by the solution of that metal in vinegar, and that, thinking it of no value, they allow it to be thrown away, I beg to mention that it consists almost entirely of silver, in a state of very minute division.

Mineralogists have long been aware that most ores of lead contain a greater or less per centage of silver, and hence it was natural to conclude that the lead procured from them should also contain silver. But it was reserved for an eminent manufacturing chemist, who was remarkable for turning chemical refuse to useful purposes, to examine this powder and collect it in such quantities as in the course of years to supply himself with many valuable articles of plate.

Your obedient servant,

December 14, 1853. W. C.

At the close of the meeting of the Royal Astronomical Society, December 9, the President stated that operations had commenced for determining the difference of longitude of Brussels and Greenwich, by means of galvanic signals, with the view of forming an electric communication between Greenwich and the principal Observatories of the Continent. With respect to the velocity of the electric current, the President remarked that, in the present instance, there was reason for suspecting it to be affected by the subterranean and submarine passage of a portion of the wire. It appeared that the time occupied by the electric current in passing from Greenwich to Brussels amounted to 1-10th of a second,—whereas the time occupied by the current in passing from Greenwich to Edinburgh, which was almost double the distance, amounted only to 1-17th of a second. The President acknowledged the obliging conduct of the authorities of the European and Submarine Telegraph Company, who had cordially co-operated in promoting the success of this important undertaking.

Monthly meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—March, 1854.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Magnet.	Day.	Barom. at tem. of 32 deg.				Tem. of the Air.				Tension of Vapour.				Humidity of Air.				Wind.				Rain in Inch.	Snow in Inch.
		6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Mean Vel'y		
						°	°	°	°														
a	1	29·934	29·878	29·865	29·886	31·5	37·0	24·8	30·72	0·163	0·174	0·115	0·148	·93	·80	·85	·85	Calm	S W b S	Calm	3·44	...	...
b	2	·788	·658	·882	·581	29·1	36·3	34·8	33·98	·149	·192	·199	·185	93	90	99	94	E N E	E	E	10·94	0·875	...
c	3	·253	·273	·376	·303	35·3	41·2	38·6	39·07	·206	·215	·210	·209	100	84	91	89	E b N	S W b W	S W	8·47	...	...
a	4	·889	·284	·461	·389	34·7	42·0	29·1	35·12	·188	·162	·143	·160	94	62	89	80	S W	S W	N W b W	9·57	...	...
b	5	·633	·710	—	—	26·6	33·7	—	—	·134	·165	—	—	91	84	—	—	W	N W b N	—	7·18	...	...
d	6	·926	·926	·775	·871	26·2	29·4	31·9	29·75	·126	·115	·160	·141	86	71	90	85	N N W	S b W	S E	3·28	...	...
a	7	·632	·535	·438	·523	33·0	36·5	35·5	34·90	·185	·188	·194	·184	99	87	94	91	Calm	Calm	E	2·88	0·240	...
a	8	·137	28·884	·367	·135	34·2	36·6	34·2	35·02	·183	·194	·183	·187	94	90	94	93	E b S	Calm	N N W	5·50	0·240	...
a	9	·440	29·436	·422	·436	32·8	35·5	30·5	32·67	·174	·197	·167	·177	95	95	98	96	E N E	E	E N E	5·03	0·685	...
a	10	·366	·303	·472	·387	34·1	36·3	33·2	34·68	·192	·190	·169	·187	98	89	87	93	N N E	N	N W b N	6·37	0·040	...
a	11	·681	·808	·835	·781	28·0	39·2	32·7	33·70	·139	·188	·166	·165	89	79	90	85	N W b N	N W b W	S W	7·69	...	...
b	12	·798	·680	—	—	30·2	44·0	—	—	·150	·224	—	—	89	79	—	—	S W b W	S W b S	—	5·08	...	...
c	13	·607	·584	·595	·595	40·2	51·0	41·2	44 00	·192	·296	·233	·242	77	80	91	84	S W	S W	E b N	4·21	0·040	...
b	14	·400	·442	·600	·487	36·3	47·2	40·3	41·5	·207	·288	·233	·245	96	90	93	93	E	S b W	W b N	5·36	0·045	...
c	15	·551	·185	28·970	·219	37·3	48·5	40·2	41·67	·199	·285	·229	·237	90	86	98	90	Calm	S	Calm	2·72	...	...
...	16	28·983	28·968	29·181	·052	49·6	52·9	34·7	43·3	·238	·315	·177	·241	95	80	89	85	W N W	W N W	W N W	10·62	...	...
b	17	29·261	28·914	·122	·099	29·2	31·6	18·7	27·1	·146	·169	·086	·138	91	95	81	89	W N W	S E b E	N W b W	12·28	...	2·2
a	18	·364	29·643	·821	·623	14·7	19·0	19·2	18·0	·080	·074	·093	·081	89	70	86	79	N W b W	N W b W	W	15·10	...	...
a	19	·896	·749	—	—	19·0	29·8	—	—	·095	·087	—	—	89	52	—	—	N W	W	—	11·33	...	0·2
a	20	·844	·980	·992	·949	14·0	20·5	19·0	18·5	·073	·069	·090	·080	82	60	82	75	N N W	N N W	N	6·85	...	...
a	21	30·030	·926	·806	·901	18·3	30·6	26·8	26·4	·088	·126	·126	·120	85	74	86	82	Calm	S	E b S	4·61	...	...
a	22	29·562	·249	·054	·266	29·4	33·0	34·3	32·8	·136	·178	·188	·168	83	93	99	90	E b S	E b S	E S E	7·80	0·100	0·4
a	23	·039	·079	·268	·138	35·5	42·5	24·8	33·37	·199	·158	·115	·153	96	57	84	80	S W b W	W N W	N W	12·78	...	...
b	24	·283	·281	·375	·316	16·9	22·4	14·3	17·47	·084	·095	·076	·085	84	77	86	84	N W b N	N W b W	N W b N	11·40	...	Inap.
c	25	·335	·319	·459	·376	14·0	25·6	21·2	20·0	·068	·112	·102	·090	78	79	86	78	N N W	N W	N W	14·76	...	Inap.
c	26	·501	·502	—	—	17·2	28·8	—	—	·085	·112	—	—	85	70	—	—	N W b N	N W b W	—	14·26	...	...
f	27	·707	·682	·799	·737	14·4	24·9	14·7	17·5	·073	·113	·072	·085	82	82	80	82	N W	W N W	N W	10·67	...	...
e	28	·855	·915	30·051	·949	10·4	23·6	16·5	17·17	·060	·069	·068	·063	80	53	69	64	N W b N	N W	N b W	8·47	...	...
c	29	30·074	30·017	29·946	30·013	12·4	28·5	24·4	21·8	·067	·088	·106	·085	80	55	79	70	N N W	S	S b E	5·07	...	...
d	30	29·848	29·714	·709	29·757	20·5	32·1	31·7	29·42	·098	·148	·155	·139	86	81	87	84	S b E	E S E	E b N	9·02	Inap.	...
b	31	·627	.461	·176	·394	34·1	39·9	39·5	38·22	·177	·203	·226	·205	91	83	94	89	E b S	E N E	E b S	6·00	0·160	...
																		Miles.	Miles.	Miles.	Miles		
	M	20·552	29·494	29·530	29·525	27·28	34·96	29·14	30·68	0·144	0·170	0·151	0·156	89	79	88	85	6·54	9·34	6·78	8·02	2.425	2·8

Highest Barometer.. 30·098, at 8 a.m. on 29th } Monthly range:
Lowest Barometer... 28·788, at 4 30 p.m. on 17th } 1·310 inches.

Highest temperature.. 55°·1, at p.m. on 16th } Monthly range:
Lowest temperature... 7°·4, at a.m. on 28th } 47°·7.

Mean Maximum Thermometer.............. 36°·82 } Mean daily range:
Mean Minimum Thermometer.............. 22°·94 } 13°·38.

Greatest daily range............... 27°·1, from p.m. 16th to a.m. of 17th.

Warmest day....... 13th. Mean temperature...... 44°·00 } Difference,
Coldest day......... 28th. Mean temperature...... 17°·17 } 26°·83.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
2368·10	3239·78	825·98	1379.74

Mean direction of Wind W 40° N.

Mean velocity of the Wind... 8·02 miles per hour.

Maximum velocity .... 25·8 miles per hour, from 9 to 10 a.m. on 18th.

Most windy day...... 18th; Mean velocity... 15·10 miles per hour.

Least windy day...... 15th; Mean velocity... 2·72 ditto.

Raining on 9 days. Raining 62·9 hours. Depth, 2·425 inches.

Snowing on 3 days. Snowing 10·2 hours. Depth, 2·8 inches.

This has been the most windy *March* during the last ten years.

The mean temperature of the first 16 days of this month has been 8°·6 warmer, whilst that of the last 15 days 8°·9 colder, than the mean average temperature of those periods respectively.

Aurora observed on 12 nights.

Possible to see Aurora on 19 nights.

Impossible to see Aurora on 12 nights.

Thunderstorm from 6 to 10 30 p.m. on the 15th.

The Aurora of the 27th was splendid, and the magnetic disturbance very great.

Comparative Table for March.

Year.	Temperature.				Rain.		Snow.		Wind. Mean Vel'y.	
	Mean.	Max. obs'vd.	Min. obs'vd.	Range.	D's.	Inch.	D'ys	Inch.		
	°	°	°	°						
1840	33·3	56·9	8·7	48·2	8	1·640	8	Not Regis'd.	Not Regis'd.	
1841	27·7	53·5	–6·9	60·4	5	1·170	7			
1842	35·8	68·7	14·9	53·8	4	3·150	8			
1843	21·3	38·6	–2·8	41·4	2	0·625	18	25·7	1·18	lb.
1844	31·3	50·3	9·6	40·7	8	2·470	8	14·0	0·57	lb.
1845	35·4	61·7	9·9	51·8	5	Imp.	8	2·8	0·66	lb.
1846	33·1	49·3	7·6	41·7	9	1·965	5	2·3	0·80	lb.
1847	26·2	44·3	4·8	39·5	5	0·850	6	4·2	0·71	lb.
1848	28·6	58·9	0·9	58·0	5	1·220	6	9·7	5·80	Miles.
1849	33·5	53·4	15·4	38·0	7	1·525	2	2·3	5·37	Miles.
1850	29·8	46·0	6·0	40·0	2	0·745	7	11·2	7·62	Miles.
1851	32·4	58·7	13·1	45·6	3	0·770	9	8·8	7·65	Miles.
1852	27·7	44·8	–3·2	48·0	8	3·080	12	19·5	5·81	Miles.
1853	30·6	56·3	–0·1	56·4	6	1·080	8	7·1	5·87	Miles.
1854	30·7	52·8	10·4	42·4	9	2·425	8	2·8	8·02	Miles.
									0·68	lb.
M'n.	30.49	52·95	5·89	47·06	5·7	1·622	7·7	9·2	6·59	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—March, 1854.
NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 Feet.

Day.	Barom. corrected and reduced to 32° Fahr. 6 A.M.	2 P.M.	10 P.M.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	Tension of Vapor. 6 A.M.	2 P.M.	10. P.M.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity in Miles per Hour. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0. 6 A.M.	2 P.M.	10 P.M.
1	29·550	29·580	29·591	8·1	42·2	33·2	·058	·243	·178	·80	·85	·85	W b S	W b S	W b S	1·17	2·15	4·31			Clear.	Cum. Str. 8.	Hazy.
2	·676	·605	·631	30·0	29·4	25·5	145	161	141	78	89	90	N b W	N E	N E b E	0·41	3·34	3·75			Do.	Cir. Cum. 4.	Clear.
3	·229	·201	·249	31·0	41·2	34·2	185	253	195	96	92	91	E b S	S	S E b E	5·55	3·17	1·55		1·10	Snow.	Cum. Str. 8.	Cir. Str. 4.
4	·223	·315	·100	30·5	47·0	32·5	168	291	160	90	86	80	N E b E	W b S	S S W	16·25	5·63	1·17			Clear.	Clear.	Clear.
5	·271	·412	·471	26·5	46·2	26·0	141	282	135	88	86	83	W b N	W N W	W N W	12·15	10·17	17·50		Inapp	Str. 8.	Cir. Str. 4.	Do. [Borealis.
6	·635	·620	·611	15·6	32·0	20·3	092	160	101	83	80	77	W N W	W b N	W S W	2·87	6·25	5·25			Clear.	Clear.	Do. Aurora
7	·474	·371	·403	26·0	40·2	28·2	123	227	144	76	85	83	S	E b N	E b N	1·87	0·11	Calm			Do.	Str. 10.	Str. 10.
8	·242	·012	28·979	22·6	27·0	26·8	127	157	156	88	90	93	N E	N E b E	N E b E	7·25	14·87	14·60		8·70	Str. 10.	Snow com. at	Snow till mid-
9	·401	·361	29·358	30·5	38·4	28·6	168	226	161	90	91	89	S S E	N E b E	N E b E	15·28	1·12	1·15		0·18	Do.	Str. 10. [noon.	Str. 10. [night.
10	·237	·112	·080	29·2	34·1	32·5	170	204	182	94	95	91	N E b E	N E b E	N E b E	12·89	4·81	3·78	0·54	Inapp	Rain.	Rain.	Snow.
11	·356	·488	·558	29·9	35·2	27·0	160	186	146	86	83	88	N W	W N W	S W b S	4·64	10·63	4·24		1.01	Str. 10.	Clear.	Clear.
12	·565	·395	·392	28·4	49·5	36·0	160	290	192	90	80	83	S W b W	S W b W	S S W	9·19	8·28	6·69			Clear.	Do.	Light Cir. L.
13	·322	·409	·364	35·0	44·0	35·0	186	223	203	83	73	90	S W b S	W N W	N E b E	1·82	1·51	1·80	0.09		Light Cir. 4.	Rain at 3 p.m.	Str. 10. [halo.
14	·342	·254	·311	26·5	27·2	29·0	147	151	170	91	89	94	N E b E	N E b E	N E	14·00	11·98	6·26	0·12		Str. 10.	Sleet.	Do. 10. [ning.
15	·449	·223	28·885	35·0	46·1	38·1	203	272	230	92	83	94	W b S	S W	S S E	Calm	Calm	3·75	0·14		Cum. Str. 4.	Str. 8.	Rain. Ligh-
16	28·735	28·687	28·710	39·0	56·4	36·0	284	323	196	91	70	85	W S W	W S W	W	2·60	6·24	15·53	0·02		Cir. Cum. Str.	Cir. Str. 4. [8.	Cir. Str. 4. A.
17	28·960	28·884	28·616	30·0	42·6	31·0	168	263	178	90	92	92	W N W	S W b W	W N W	11·75	12·50	3·75			Clear. [4.	Cum. Cir. Str.	Snow. [Bo.
18	28·856	29·183	29·390	5·0	12·0	13·0	053	085	083	85	88	82	W N W	W N W	W N W	25·16	26·66	19·65		3·10	Snow.	Cum. Str. 10.	Cir. Str. 2.
19	29·501	·887	·891	9·0	23·7	18·6	069	120	089	82	80	83	W b N	W b N	N W	17·10	16·66	7·25			Clear.	Clear.	Clear. [Bo.
20	·551	·592	·688	9·5	17·0	8·1	060	090	070	80	78	90	N W	W	W	4·80	7·90	6·50			Do.	Do.	Do. Aurora
21	·798	·666	·611	2·5	27·2	14·0	042	128	067	76	76	71	W N W	W S W	W S W	Calm	0·62	1·12			Do.	Do.	Do. do.
22	·589	·378	·211	0·0	30·5	24·1	041	148	116	88	81	88	N E	N E b E	E b N	Calm	1·93	1·01			Do.	Light Cirrs.	Str. 10.
23	·002	28·948	28·951	28·0	35·0	33·0	153	203	197	88	91	95	S S E	S	S	11·50	8·44	1·40		1·20	Snow.	Str. 10.	Do.
24	28·934	28·888	28·989	26·0	24·6	14·0	129	135	080	80	86	78	W	W	W	8·75	14·57	18·50		1·36	Slight Snow.	Snow.	Cir. Str. 4.
25	28·968	28·939	29·002	11·0	16·5	12·2	067	084	075	73	78	78	W	W	W b N	14·13	13·95	15·37		2·55	Snow.	Str. 4.	Snow.
26	29·221	29·145	·260	8·6	16·0	14·0	058	081	080	80	78	78	W b N	W b N	W b N	17·47	12·25	18·83		8·42	Cum. Str. 9.	Str. 10.	Str. 10.
27	·815	·367	·428	10·5	18·5	12·0	076	073	086	85	73	83	W b N	W b N	N W b W	11·66	21·29	6·62		1·00	Str. 10.	Cir. Str. 10.	Cum. Str. 4.
28	·478	·522	·652	7·7	20·3	15·0	063	101	078	90	77	73	W N W	W	W N W	12·08	5·11	10·00			Cir. 4.	Do.	Clear. [Bo.
29	·763	·678	·719	8·0	32·2	15·1	060	167	083	80	83	78	N N W	S W	W S W	3·62	7·97	5·07			Clear.	Clear.	Do. Aurora
30	·750	·666	·710	10·7	31·2	20·2	082	141	094	88	72	72	W S W	N E	N E b E	1·00	1·46	0·17			Do.	Cir. Cum. 6.	Do. do.
31	·586	·501	·356	16·1	38·0	35·0	081	173	208	78	70	91	N E b E	S E b S	S E b S	7·52	7·10	12·22			Str. 10.	Str. 10.	Str. 10.

Barometer	Highest, the 29th day	29·763
	Lowest, the 16th day	28·687
	Monthly Mean	29·024
	" Range	1·076
Thermometer.	Highest, the 16th day	56°·4
	Lowest, the 21st day	–4°·0
	Monthly Mean	25°·84
	" Range	60°·4
	Mean Humidity	·840
Greatest Intensity of the Sun's Rays		130°·1

Rain fell on 5 days, amounting to 0·910 inches.
Snow fell on 12 days, amounting to 28·61 inches.
Most prevalent Wind, N E b E.
Least prevalent Wind, S S E.
Most Windy Day, the 18th day; mean miles per hour, 23·83.
Least Windy Day, the 21st day; mean miles per hour, 0·58.
Aurora Borealis visible on 6 nights. Might have been seen on 7 nights.
Lunar halo on 1 night.
The electrical state of the atmosphere has been marked *generally* by moderate intensity of a positive character, and during the storm of the 26th day indicated a very high tension of positive electricity.

Monthly Meteorological Register, Quebec, Canada East.—March, 1854.

BY LIEUT. A. NOBLE, R.A.

Latitude, 46 deg. 49·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea, — Feet.

Date.	Barometer corrected and reduced to 32 degrees, Fahr. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN	Elasticity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity of Miles. 6 A.M.	2 P.M.	10 P.M.	Rain in inch.	Snow in inch.
					°	°	°	°																
1	29·920	29·871	29·887	29·893	10·0	33·8	32·0	25·2	·058	·164	·156	·126	79	85	87	84	W S W	W S W	W S W	6·2	6·2	8·0	...	...
2	30·062	30·099	30·156	30·105	24·0	25·5	11·5	20·3	116	109	058	094	87	78	75	80	E b N	E N E	E N E	5·2	7.2	12·4	...	...
3	29·943	29·704	29·622	29·756	19·5	20·5	21·5	20·5	095	092	098	095	86	81	81	83	E N E	E N E	E N E	21·2	21·2	16·0	...	6·0
4	·589	·902	·452	·647	24·0	29·6	25·5	26·3	116	143	134	131	87	87	95	90	E N E	E N E	E N E	6·2	8·0	5·2	...	4·0
5	·406	·534	·605	·515	25·0	38·0	23·5	28·8	112	140	112	121	81	62	86	76	W	S W	S W	5·2	8·0	5·2	...	...
6	·804	·898	·982	·895	18·0	31·0	24·6	24·5	082	117	117	105	80	67	87	78	S W	S W	S W	5·2	10·1	8·0	...	...
7	·897	·765	·702	·788	21·4	39·8	23·2	28·1	100	156	111	122	84	64	86	78	W b S	W b S	Calm	5·2	5·2	...	...	0·5
8	·685	·480	·886	·517	10·4	29·3	25·0	21·6	060	149	122	110	80	93	88	87	Calm	E b N	E b S	...	13·9	31·2	...	5·0
9	·601	·720	·788	·703	25·4	31·4	28·0	28·3	115	140	139	131	82	80	89	84	E b S	E b S	E b S	21·2	21·2	12·4	...	...
10	·659	·592	·415	·529	27·8	32·8	30·0	30·2	135	145	134	138	88	78	80	82	E b S	E b S	E b S	13·9	16·0	16·0	...	7·0
11	·473	·717	·897	·696	27·4	43·0	38·6	36·3	141	169	204	171	93	62	87	81	N b W	N W	N W	11·3	10·9	10·1	...	...
12	·399	·681	·677	·586	26·5	42·5	38·6	35·8	128	176	186	163	87	66	80	78	N W	N W	NWbW	8·0	8·0	7·2	...	...
13	·722	·774	·915	·803	37·5	35·4	32·0	35·0	178	127	171	159	79	61	95	78	NWbW	E b S	E b S	5·2	6·2	8·0	0·04	1·0
14	·975	·732	·630	·779	23·0	25·6	26·2	24·9	104	128	142	125	81	90	98	90	E b S	E b S	S E	13·9	22·1	12·4	...	0·5
15	·653	·658	·442	·591	28·6	46·0	35·5	36·7	145	218	188	184	92	70	91	84	S W	S W	S W	8·8	8·0	8·0	...	...
16	28·932	28·829	28·910	28·890	38·5	48·8	38·0	41·8	209	213	158	158	91	63	68	74	Calm	W	N W	...	10·1	9·6	0·09	0.3
17	29·021	29·181	28·987	29·046	30·0	40·3	26·5	32·9	141	241	134	172	84	97	84	88	N W	W	W b N	11·3	16·0	13·9	...	8·0
18	28·781	28·948	29·446	·058	7·0	17·6	23·0	15·8	053	084	107	081	81	83	84	86	W N W	W N W	W b N	19·7	32·1	27·8	...	4·0
19	29·678	29·570	·567	·605	7·5	22·8	8·5	12·9	052	103	050	068	79	81	73	78	NWbN	NWbN	NWbN	19·7	16·0	10·1	...	...
20	29·730	·818	·980	·843	0·0	17·0	10·5	9·1	036	071	069	059	76	72	94	81	NWbN	NWbN	NWbN	10·1	11·3	10·9	...	...
21	30·051	·977	30·008	30·012	1·3	24·0	10·0	11·7	041	082	060	061	82	63	81	75	NWbN	NWbN	NWbN	11·3	11·3	3·8	...	...
22	29·980	·804	29·618	29·801	–0·3	26·0	19·2	14·9	036	128	091	085	78	88	83	83	NWbN	NWbN	NWbN	8·0	6·2	10·1	...	...
23	·465	·877	819	·887	18·0	32·3	31·0	27·1	093	163	165	140	91	90	95	92	S E	S E	S E	10·1	18·9	20·2	...	9·0
24	·179	·088	·014	·093	28·6	30·8	28·0	29·1	137	144	128	136	87	83	83	84	S E	S E	S E	21·2	27·8	10·1	...	9·0
25	·081	·047	·063	·064	16·3	23·0	17·0	18·7	090	123	085	099	93	97	86	92	W	W	W	11·3	19·7	16·0	...	2·0
26	·121	·201	·330	·217	8·0	23·0	19·8	16·9	059	086	092	079	87	67	82	79	W	W	W S W	19 7	19·7	19·7	...	...
27	·409	·460	·571	·480	12·8	21·8	13·0	15·8	078	107	057	081	93	89	68	83	W S W	W S W	W S W	16·0	16·0	11·3	...	...
28	·638	·724	·864	·742	13·0	34·3	21·0	22·7	075	158	102	112	88	79	88	85	W b N	W b N	W b N	11·3	13·9	11·3	...	...
29	·924	·993	30·080	·999	13·0	27·2	18·5	17·9	052	124	071	082	62	82	82	75	W b N	W b N	W b N	10·1	7·2	5·2	...	...
30	30·134	30·070	30·148	30·117	8·8	31·3	16·3	18·8	058	104	092	083	76	59	95	77	Calm	S W	Calm	...	5·2	...	...	...
31	30·168	30·073	29·871	30·036	18·0	26·2	29·0	24·4	097	113	148	119	94	79	94	89	Calm	E S E	E S E	...	8·0	...	...	...
M	29·615	29·618	29·624	29·619	18·3	30·6	23·9	24·3	096	136	118	116	84	77	85	82				10·2	13·1	10·9	0·18	55·8

REMARKS.

7th. Snowing slightly.

8th. Heavy fog during the morning.

16th. Thunder and lightning, accompanied with hail and rain.

20th. Clear, but no Aurora observed.

21st. Aurora observed. A luminous arch with dark segment, but no streamers.

22nd. Aurora observed. Two mock suns seen, 10 p.m.

23rd and 24th. Very heavy fall of snow.

26th. Aurora visible through the clouds.

29th. A comet visible just after sunset. A very remarkable Aurora, consisting of three arches; one in the north, another passing through the zenith, and a third in the south.

30th. Aurora observed. A great deal of motion.

Highest Barometer, at 6 a.m. on the 31st................ 30·163 } Monthly Range, 1·382 in.
Lowest Barometer, at 6 a.m. on the 15th................ 28·781 }

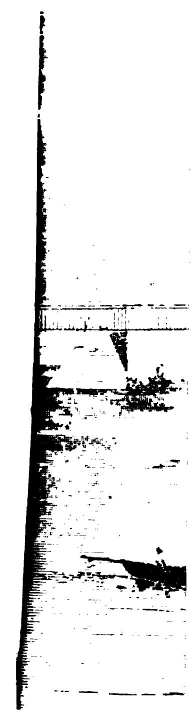
Maximum Thermometer, on the 18th........................ 50°·0 } Monthly Range, 52°·0
Minimum Thermometer, on the 19th........................ –2°·0 }

Mean Maximum Thermometer.............................. 31°·9 } Mean Daily Range, 17°·5
Mean Minimum Thermometer.............................. 14°·4 }

Greatest Daily Range, on the 17th........................ 35°·0
Least Daily Range, on the 14th............................ 5°·6

Warmest Day, the 16th; mean temperature.............. 41°·8 } Climatic Difference, 32°·7
Coldest Day, the 20th; mean temperature................ 9°·1 }

Possible to see Aurora on 12 nights.
Aurora visible on 10 nights.



The Canadian Journal.

TORONTO, JUNE, 1854.

Memoranda of Vesuvius and its Neighbourhood.

the Rev. Henry Scadding, D.D., Cantab. Read before the Canadian Institute, March 25th, 1854.

Continued from page 241.

We shall now pay a rapid visit to the volcanic district west-ards of Vesuvius—appropriately named the Phlegræan fields, he fields of fire," if the Greek etymology of the name be the rect one. We shall tread on ground teeming with recollec-ns of illustrious or remarkable men. I shall be pardoned, en, if here and there, though still looking at things in general in volcanic point of view, I indulge in some brief historical notices I pass. Traversing the whole length of the ever-lively Naples—here, doubtless, we have before our eyes a picture of an old Greek mmunity, in modernized costume,—we arrive on its western side a tunnel perforating the mass of ancient volcanic tufa, known the hill of Posilipo. Here, before you enter, you may leave our carriage for a short time, and ascend by some steps on the ft, and examine the dilapidated columbarium to which tradition oints as once the receptacle of the ashes of Virgil. It is certain hat the poet had a house on this hill, and that therein he com-osed his Georgics and Eclogues and the greater portion of his Æneid. It is a spot which harmonizes well with the poet's me-mory, having within view numerous localities whose names have become household words through his pen—a spot rendered in an additional degree venerable now, by reminiscences of illustrious men, who, from Statius and Petrarch, to Milton, Thomson, and Gray, with pious steps, have visited it.—Milton at the tomb of Virgil! Was it not there, while standing at the shrine of a kindred soul, that the inspiration, already stirring the fair young English bard, shaped the effectual resolve to leave words behind him which the world "should not willingly let die?"—It is curious to remember that in the middle ages the name of Virgil was popularly known only as that of a magician—doubtless from the assumed famili-arity which he exhibits in his 6th Book with the world of spirits. It was from the prevalence of this idea, that Dante made him the conductor of himself through the realms below.—Dante in his turn was, for similar reasons, pointed at by the rustics of his day as the man who had visited the abodes of the dead. And to close the list of popular misunderstandings in respect to fa-mous persons—Horace, by the peasantry in the neighbourhood of the Sabine farm, is at this moment believed to have been an Englishman, from the numerous English who take such pains to scramble to the spot.—But we must return to the tunnel below, which itself—though it bears to this day visible marks, not of the magician's wand, but of instruments more substantial —was once popularly attributed to the supernatural power of Virgil. It may be briefly described as 2244 feet long, 21½ feet wide, from 69 to 25 feet in height; gloomy, dusty, and unsavory. There are several other similar grottoes, as they are illusively called, in this neighbourhood—all artificial, and dating back before the Christian era. They are short cuts from town to town, made through the rather soft volcanic rock.—You are now on the road which leads to Pozzuoli. You are interested at observing evi-dences of the latitude in which you are. You notice in the hills specimens of the palmetto-palm. You perceive the stone-pine—the familiar object in Italian views—stretching out its flat pecu-liar top. You see the aloe and the cactus in profusion. You observe peasants under trees dancing to the sound of the guitar. You meet rude ass-drawn and ox-drawn vehicles loaded with strange tropical-looking fruits and vegetables.

You soon enter upon the Phlegræan fields in earnest. You arrive at the well known Lake Agnano—an irregularly-shaped ancient crater, three miles in circumference, filled with a sheet of water. From fissures in its walls issues sulphurous vapour of a temperature of 180° Fahrenheit, showing that a highly heated mass is not far off. Here you have exhibited to you the world-famous but rather insignificant *Grotto del Cane*—a small cell containing a spiracle from below, up which rushes carbonic acid gas, mingled with steam.—A little to the westward you come to another partially extinct crater—the Solfatara—an irregular oval plain, sounding treacherously hollow to the tread, and full of steaming and smoky fumeroles, which at night emit a glow as from a furnace, showing that they communicate immediately with red-hot material. Within the base of what was the ancient cone of the Solfatara, in the far depths, water is incessantly heard heard in the act of boiling, in which state it finds an outlet. It is stated to be an aluminous water containing iron, lime, and free sulphuric acid. Some of the hills which form part of this an-cient crater are white with an aluminous efflorescence.

You next approach Astroni, a very perfect crater, four miles in circumference, bearing on its floor three small but deep lakes. It reminds you, on a small scale, of those circular valleys, which, with the aid of a good telescope, you see on the surface of the moon. Indeed I doubt not but that in these Phlegræan fields, we have by analogy many hints given of what we should meet with, were we permitted to take a stroll on the lunar disc.—Travelling still westwards, you come next to a very conspicuous and per-fectly formed crater, three miles and a half in circumference—Monte Barbaro (the ancient Gaurus)—covered with vineyards producing the wine which Horace sings of as Falernian; and near by are two more similar craters, only smaller—Cigliano and Campana. Proceeding yet westwards, you come to Avernus itself, the dread entrance to Hades. In the old prehistoric era, this crater no doubt possessed some of the awfulness of the pre-sent interior of Vesuvius. The Cumæan colonists transplanted to this neighbourhood the myths of their native Greece, and easily established Campanian duplicates of their own Styx, Co-cytus, and Acheron. Here is the scene of the well-known *Nekuia* of the 11th Book of the Odyssey, and of the descent of Æneas in the 6th Book of the Æneid. The ancient Italians must have enjoyed these references of the poets more keenly than modern readers can. They must have felt the Æneid to have been a *national* poem much more thoroughly than we do—the mere *naming* of a locality being sufficient to call up to their minds the often visited spot—with its brilliant colouring and his-toric and poetic associations.—Avernus is now a cheerful place; a beautiful lake, abounding with fish, lies in its basin, and over it and on it feathered fowl sport with impunity. The etymology of Avernns (quasi *Aornos*, "birdless") is now supposed to be fanciful, though Virgil, and Lucretius before him, adopted it. The true origin of the name appears to be in the Phœnician *Evoron*, denoting "gloom" or "darkness." But though the old composition of the name may not be true, still it is probable that in the ancient times birds would seldom be seen about the spot. Instinct would lead them to shun the breath of a volcano, as surely as it leads their congeners to revel so joyously, as we see them doing, in the wholesome spray of our Niagara.

The hills on the northern side of this lake—the walls of the ancient crater—are richly covered with chestnut trees and vines. The rim of the bowl on the southern side has been broken down, just as we have seen the southern side of the ancient crater of Vesuvius carried away. It is in consequence of a celebrated "cut" made by Agrippa—the bold engineer-statesman to whom Augustus owes so much of the eclat of his reign—that we see the lake of Avernus reduced to the limited dimensions of a mile and a half in circumference, and five hundred feet in depth. Between it and the sea, towards the south-east, we can see the famous *Lacus Lucrinus*, itself a crater, lower down on the flank of the ancient volcano. Into this Lake Agrippa admitted the sea by a canal; then by another canal he let down Avernus into Lucrinus—thus forming a magnificent double dock, where the Roman fleet, quadrupled, might float securely. This port, a grand topic with the poets and historians of the day, existed in good order until A.D. 1538, when the long dormant volcano over which the united lakes reposed suddenly awoke.—A short distance to the south-east, you may observe a conspicuous hill, resembling the cone of a volcano. This is the celebrated Monte Nuovo, which was thrown up in the space of forty-eight hours on the occasion now spoken of. After a succession of volcanic shocks a fissure took place near the Lucrine Lake; from the aperture rose to a great height, first cold water, then hot;—then followed masses of ashes and lapilli, descending on the country in torrents of mud; then followed vollies of dry ashes and red-hot pumice stones. And in forty-eight hours a hill was formed 440 feet in height, and a mile and a half in circumference, filling up a large portion of the Lucrine Lake, and ruining Agrippa's harbour. On the top of the hill is a crater one fourth of a mile in circumference, and 419 feet deep. It is only of late years that the scoriæ on its surface have become sufficiently decomposed to admit of the growth of small trees thereupon. The line of the coast in the immediate neighbourhood was, during this explosion, elevated to such an extent that the sea seemed to have retired 400 paces.—The protrusion of the mountain of Jorullo, in Mexico, in A.D. 1759, is a well known parallel to Monte Nuovo. Both are interesting, as throwing light on the nascent condition of volcanic hills.—To the south-west of the Lucrine, you come to Fusaro (the old Acherusian), famous to this day for its oysters, another water-filled crater, and still further on is Mare Morte, another. To arrive at the latter, you pass through Elysium—the tract which is said to be the original and veritable prototype of that fair creation of the poets.

To the north of Avernus, I should have mentioned just now, one more crater is traceable in this region; and a fragment of its ancient walls constitutes the acropolis of the venerable Cumæ, the earliest Greek settlement in Italy.—The Lake Licola, to the north of Cumæ, which *looks* like one of the system of volcanic lakes, which we have been tracing out, is in reality, it is said, the remains of the canal which Nero is known to have commenced with the intention of carrying it through the Pontine marshes as far as Ostia.

From Mare Morte, or rather from the beach called Miliscola—corrupted from *Militis schola*, an ancient military parade-ground—we take the ferry and cross a narrow strait of two miles to the island of Procida, and from thence, over two miles more of sea, to Ischia. These two pyramidal masses—so impressed on the memory of the visitor to Naples, and so celebrated in song and history—are stated by those who have scientifically examined them, to be parts of one great volcanic mountain. Here, prior to the awakening of Vesuvius in A.D. 79, was the principal safety valve of this fiery region.—Homer, Pindar, Virgil, and Ovid celebrate the eruptions of Mount Epomæus in this identical Ischia; and here Typhoëus was fabled to be buried. Once only since the Christian era, has it exhibited activity. In 1302 great damage was done by an eruption of lava.

We now make the trajet back from Ischia to the mainland again. We pass the conspicuous promontory of Misenum—retaining, in accordance with the poet's prediction, "æternum per sæcula nomen." On the left we coast along by the once voluptuous and still beautifully situated Baiæ—the favorite watering-place of southern Italy in its old palmy days. As you gaze now into the sea two hundred yards from the shore, you see the sunken substructions of villas, temples, and baths—the former haunts of luxurious emperors, patricians, poets, and orators. This coast, too, has known the presence of Hannibal, Alaric, Genseric, and Totila.—You have Pozzuoli—the old Puteoli before you—covering the flanks and summit of a bold hill jutting out into the sea; the dark masses which you observe at regular distances above the sunny surface of the calm water, are the piers of its ancient mole, once surmounted by a light. We land on the west side of the hill. We are conducted at once to the Serápeon which stands near—a temple of the Egyptian Serápis—a ruin which has become memorable among physical observers—as proving to the eye, by the perforations of the marine borers called Lithodomi in its still erect columns, that the land, subsequently to the erection of the building, must have gently sunk and remained submerged for many years, and then that it must as gently again have been raised. The perforations on the columns are now seen at a height of twelve feet; they cover a space of nine feet; and then above them comes an uninjured space of twenty feet, which must have been the portion of the columns appearing above the surface of the sea, when the stratum on which they stand had sunk down to the lowest point. The shore is supposed to be again descending. In order to approach the pillars for close examination, you have to walk through an inch or two of salt water. The edifice has been large. Its exterior colonade was 140 feet long, 122 feet wide. Here was found the remarkable sitting figure of Serápis, having his hand on a three-headed dog, now to be seen in the Museum at Naples.

We must not delay in Puteoli, though its associations tempt one to do so. As the southern terminus of the Appian way—a high road to Rome—it was, before Naples existed, the principal focus of the Italian trade with the East. The Greek colonists from Cumæ called the place Dicæarchia; but the Romans preferred the appellation "Puteoli," as having, in sound at least, an allusion to the hot sulphureous "wells," which abound in this volcanic locality.—Here we tread in the foot-prints of St. Paul; and standing on the now solitary beach, we can perhaps more vividly realize the interesting fact than we do when surrounded by the mosaics and marbles which encrust his shrines in Rome. The Apostle, as we know from Acts xxvii. 13, landed at Puteoli a prisoner in chains, and after his perilous voyage was allowed to rest here for seven days.—On a neighbouring rising ground you may be conducted over a remarkably perfect amphitheatre [480 by 382 feet], where, in A.D. 66, Nero contended publicly with wild animals, and where, in the time of Diocletian, Januarius, the supposed patron of Naples, with other Christians, suffered martyrdom. Here you may also be conducted over no inconsiderable remains of the Villa Puteolana of Cicero—familiar to the reader of his letters to Atticus, and distinguished as the spot where he wrote his *Quæstiones Academicæ* and his work *De Fato;* and also as the place where the Emperor Hadrian died.

Passing through Puteoli towards the east, you come out on a noticeable stripe of land between the precipitous cliff and the sea. By the marine deposits here found, mingled with the remains of human workmanship, it appears that this stripe, like the shore westward of Puteoli, has been successively depressed and elevated. On the sides of the cliff, 35 feet above the present sea level, the borings of lithodomi may be observed, and on the summit of the cliff are substructions of villas which once overhung the sea.

As you leave this narrow stripe, the road by which you travel passes through a massive stream of solid lava, which, in prehistoric times, flowed down from the Solfatara already visited, and here entered the sea in a stream one-fourth of a mile in breadth, and seventy feet in thickness.

You pass, also, on the left, some stone quarries, in which, exposed to the hottest rays of the sun, you see—for the first time perhaps, in your life—unfortunate human beings working in iron fetters. Alas! that the clank of those degrading links should be associated for ever in the recollections of any one with the name of Italy!—The labourers in the stone quarries of Epipolæ—whom, perhaps, your imagination may summon up—were more happy. The fortune of war had placed them there. But what is it that, in the Neapolitan states, according to the testimony of Mr. Gladstone, causes men, and perhaps some of these, to be thus condemned to chains?

Proceeding by the coast road homewards towards Naples, you remark, to the westward of the heights of Posilipo, a few hundred yards from the shore, a small island. This is Nisida, the last volcanic object in the neighbourhood of Vesuvius, which we have to notice. It is a cone with an extinct crater, into which, on the south side, the sea finds an entrance by a breach in the rim. A convenient little harbour is thus formed.—You may gaze on the island of Nisida with interest, for several historical reasons. Here Lucullus, the celebrated conqueror of Mithridates, possessed a villa, which, a few years after his death, became remarkable as being the place to which Marcus Junius Brutus retired after participating in the assassination of Cæsar, and where he left his Portia, the daughter of Cato, when he departed for Greece, destined never to return. It was here, too, that the interview took place between him and Cicero, of which the latter has left a graphic account, wherein the orator declares that he found the patriot "nihil nisi de pace et concordiâ civium cogitantem." In yonder little volcanic isle we have, then, a memento of the final but unsuccessful struggle for Roman liberty. We, curiously enough, have before us in the same object the scene of the extinction of the Western empire itself in the person of its last chief.—In exile here, a pensioner on the generosity of Odoacer, the first king of Italy, lived and died the son of Orestes, Romulus Augustulus, the closing member of that series of puppets who, from A.D. 455 to 476, filled the throne and brought contempt upon the name of the Emperors of the West.

Since the great explosion of Vesuvius in A.D. 79, the craters of the Phlegræan fields appear to have become for the most part quiescent. The interruptions of their repose have been three, already noticed in passing: one in 1198, when the Solfatara emitted a stream of lava; one in 1302, when Epomeo, in Ischia, did the same; the third in 1538, when Monte Nuovo was thrown up.

The intervals which have occurred between the fifty-two eruptions of Vesuvius, since that of A.D. 79, I make out to be respectively the following—124 (years), 269, 40, 308, 43, 13, 90, 167, 194, 131, 29, 22, 12, 2, 2, 3, 6, 5, 5, 3, 8, 2. 7, 14, 3, 4, 2, 6, 1, 3, 6, 3, 5. 2, 1, 6, 10, 1, 4, 3, 1, 4, 3, 2, 6, 3, 3, 4, 6, 2, 3 (1850).

In the earlier portion of the Christian era, some eruptions may not have been recorded. The generations of men who could forget the sites of considerable cities may have neglected to record the activity of a volcano. If there have been no omissions, the eruptions of Vesuvius appear to have become more frequent since the year 1631.—It has also been observed that there is a degree of alternation between the movements of Etna and Vesuvius. In no instance have the two mountains been in active eruption simultaneously. Hence they appear to be escape-valves to one connected mass of igneous matter—the upward pressure of the elastic gases with which it is charged finding relief by the one, when the other is obstructed.

While standing on the summit of Vesuvius, and contemplating the enormous column of steam which is generally in the act of being blown off, one is inclined to rush to the conclusion that the molten rock which overspreads the surrounding scene far and wide, has been shot up by nothing more or less than the familiar force which, with such irresistible power, lifts the piston. But further reflection induces a correction of this opinion. It is likely that the steam is simply produced by the infiltration of sea-water on the heated mass within the base of the mountain.

When we consider the fact that the ground on which we tread is but the surface of a rind,—that by experiment this rind increases 1° Fahrenheit in temperature for every fifty-four feet of vertical depth,—that at the depth of twenty miles granite must be in a state of fusion—we cannot fail to see that it is probable that the seat of all volcanic energy is in some common central igneous mass with which all the volcanic vents more or less communicate; and that these vents are very possibly established and maintained in order that the globe may not one day fly to pieces like a Rupert's drop.

But what is it that determines the moment when those fierce ebullitions must occur which ruffle the surface of the Phlegethon below, and cause its molten waves to rise on high, and so rudely flout the roofs of the cavernous crypts over which men dwell, shaking them and their structures, "massy-proof," from their propriety? What generates those expansive gases whose excess from time to time thrusts up before them the fiery fluid through which they seek to force their way?

These are queries which remain unresolved. Like the storms which observers notice, but cannot explain, in the magnetic world—these movements in the inner abysses of the earth must still, for the present, be classed as mysteries.

We doubtless here have glimpses of the forces, whatever they are, which, in the old foretime of our planet's history, burst apart the primitive crust; which tilted its strata in divers directions, as the uneasy polar sea bursts up its ice; which exposed huge sections of those strata with their contents, to the view, the use, and the delight of men; superinducing, apparently, at first, a scene of ruin,—harsh, sharp, bare, and confused; a scene, however, which resolved itself at last into what we now call mountain, hill, and vale; interspersed with river. cataract, lake, and sea; softened in outline by abrasion and disintegration, by slopes of alluvion and surfaces of mould, and coloured warmly over by mosses, lichens, herbage, and woods, and blue etherial haze.

But though the seat of volcanic energy be at the core of the globe, and its force, as is most probable, supplied by chemical agency operating there on an enormous scale—may it not be

possible to explain, in some instances, some of the visible phenomena on mechanical principles? May there not be, in the case of many volcanoes, rude natural channels and reservoirs within the stratified parts of the earth's crust, into or through which the fiery fluid may pass, on its rising towards the surface—channels which, having a certain amount of inclination, may cause liquid lava to act as water in the hydraulic ram, producing earthquake-shocks when the throes are ineffectual—and ejections of matter high into the air, when a passage has at last been cleared?—reservoirs, in the shape of huge natural caverns, which, gradually becoming filled with the rising fluid, produce, by atmospheric compression over its surface, a continuous stream for a time—like the air-box in the fire-engine?

I conclude with the remark that in Canada—in western Canada, at least—we appear to be happily situated outside the circle of dangerous volcanic influence. It is true we now and then hear of vague rumblings at St. Catherines and Dundas; of a sort of volcanic tide-wave in the Lake near Cobourg; of detonations on the north shore of Lake Huron. We are assured, also, that an undulation of the earthquake at Lisbon in 1755 was felt on Lake Ontario.—We know that in 1663, in the lower portions of the Province, there was an earthquake with volcanic ashes, which lasted for six months; that in 1785, and again in 1814, at Quebec, there was pitchy darkness at noon-day, with black rain and volcanic ashes—due, it has been supposed, to a crater in the terra incognita af Labrador. We can see, moreover, that the basin of Lake Superior, in the far dim foretime of this continent, was a focus of volcanic action. We notice trap in the river Ste. Marie, and Gros Cap is porphyritic. Col. Fremont describes an extinct crater in the neighbourhood of the Great Salt Lake, and an active volcano, 70 miles to the north-east of San Francisco. Mount Elias, in the Russian territory, is an open volcanic vent. And Commander McClure, of the *Investigator*, reports lava along the American coast of the Polar Sea. But in Canada, on the whole, it is a matter of congratulation that we have thus far been permitted to acquire a strong confidence in the ground on which we tread, and that we are spared the presence amongst us of any of those points of communication between the upper and nether worlds—which in other lands are exceedingly interesting,—but also sometimes very inconvenient.

On the Chemical Composition of Recent and Fossil Lingulæ and some other Shells.*

By W. E. Logan, F.R.S., and T. S. Hunt.

In the Report of Progress of the Geological Survey of Canada for 1851-52, we have mentioned the existence of small masses, containing phosphate of lime, and having the characters of coprolites, which occur in several parts of the Lower Silurian rocks. In a bed of silicious conglomerate towards the top of the calciferous sandstone, at the Lac des Allumettes, on the Ottawa, they are abundant in cylindrical and imitative shapes, sometimes an inch in diameter. The same material forms casts of the interior of a species of Holopea or Pleurotomaria, and often fills or completely incases the separated valves of a large species of Lingula, which Salter has referred to *L. parallela* of Phillips. The phosphatic matter is porous, friable, and of a chocolate brown color; it contains intermixed a large quantity of sand; and small pebbles of quartz are sometimes partly imbedded in it. The analysis of one specimen gave 36 per cent of phosphate of lime, with 55 per cent. of carbonate and fluorid, besides some magnesia and oxyd of iron, and 50 per cent. of silicious sand.

Similar masses occur in the same formation at Grenville, and in the lower part of the Chazy limestone at Hawkesbury, in both cases containing fragments of Lingula. Those from the latter place are rounded in shape, and from one-fourth to one-half of an inch in diameter, blackish without, but yellowish-brown within, and having an earthy fracture; the analysis of one of them gave:

Phosphate of lime, (PO_5, 3Ca O), -	44·70
Carbonate of lime, - - - - -	6·60
Carbonate of magnesia, - - - -	4·76
Peroxyd of iron, and a trace of alumina,	8·60
Insoluble silicious residue, - - - -	27·90
Volatile matter, - - - - -	5·00
	97·56

From the color it is probable that the iron exists as a carbonate. When heated in a tube, a strong odor like burning horn is perceived, accompanied by ammonia, which reddens tumeric paper, and gives white fumes with acetic acid, showing that a part at least of the volatile matter is of an animal nature. The specimens from Lac des Allumettes lose 1·7 per cent. by gentle ignition, with a like production of ammonia, and an odor of animal matter; the same thing was observed with those from Grenville.

The existence in Lower Silurian rocks of these masses, whose characters leave no doubt that they are coprolites, and whose chemical composition is like that of the excrements of creatures feeding upon vertebrate animals, led us to examine the shells of the Lingulæ always associated with these phosphatic bodies. The result has been that all the specimens yet examined consist chiefly of phosphate of lime; they dissolve readily with slight effervescence in hydrochloric acid, and the solution gives with ammonia a copious precipitate readily soluble in acetic acid, from which oxalic acid throws down lime. With a solution of molybdate of ammonia there is obtained a quantity of the characteristic yellow molydo-phosphate, many times greater than the bulk of the shell.

We have thus examined *Lingula prima* and *L. antiqua*, from the Potsdam sandstone, *L. parallela* from the calciferous, and a species somewhat resembling *L. quadrata* from the Trenton limestone. It was desirable to compare with these the shell of a recent species, and for this purpose fine specimens of the *Lingula ovalis* of Reeve, from the Sandwich Islands, were furnished us by J. H. Redfield, Esq. of New York. The shell of this species had the same composition as the fossil ones, and the thick green epidermis, which swelled up like horn when heated, gave a bulky white ash of phosphate of lime.

For a further analysis the shell was boiled in water to remove all soluble matters, the soft parts still adherent were carefully detached, and the shell, with its epidermis weighing ·186 grammes, was calcined over a spirit lamp. The brownish residue, weighing ·114 grammes, readily dissolved with slight effervescence, in dilute hydrochloric acid, leaving but a few light flakes of carbonaceous matter. Acetate of soda and perchloride of iron were added to the solution, which was boiled, and the precipitated basic salt separated by filtration, and decomposed by hydrosulphuret of ammonia. The filtrate from the sulphuret of iron having been concentrated, the phosphoric acid was thrown down by ammonia with a magnesian salt; there was obtained ·070 grms. of pyro-

* See page 195 for a previous notice of this discovery.

phosphate of magnesia, equal to ·044 of phosphoric acid, or ·0978 of phosphate of lime, PO_5, 3CaO.

The lime was separated from the acetic filtrate, as an oxalate, and gave ·108 of carbonate, equal to ·0605 of lime, being an excess of ·0075 over the amount required to form the phosphate, and corresponding to ·0134 of carbonate; the small amount of material did not permit us to determine whether a portion of the lime exists as fluorid. There was also obtained ·0032 of magnesia; the results from the calcined shell of *Lingula ovalis* are then as follows:

Phosphate of lime,	·0978	=	85·79 per cent.
Carbonate of lime,	·0134	=	11·75
Magnesia, - -	·0032	=	2 80
	·1144	=	100·34

The proportion of phosphate of lime is that contained in human bones, after their organic matter has been removed.

The texture of the ancient Lingulæ was observed to be unlike that of most other fossil shells, being more or less dark brown in color, brilliant, almost opaque, and not at all crystalline. These characters are also found in the allied genus *Orbicula*, and we therefore examined an undescribed species of it, from the Trenton limestone, beautifully marked in a manner resembling *Conularia granulata*, and another large species, also undescribed, from the Upper Silurian; both of these consist chiefly of phosphate of lime; and the shell of a recent species, *O. Lamellosa* from Callao, was found to be similar in composition. We have not yet been able to examine a specimen of the genus *Obolus*. The same dark color and brilliancy were also remarked in the genus *Conularia*, and the shell of *C. trentonensis* proved on examination to be composed in like manner of phosphate.

The similarity of composition in these genera is in accordance with the acute observations of Mr. Hall, who finds that *Conularia* is almost always associated with *Lingula* and *Orbicula*, and remarks that "these shells, so unlike in structure and habit, appear to have flourished under similar circumstances, and to have required the same kind of ocean bed or sediment."—Palæontology, vol. 1, p. 101.

For the sake of comparison, we have examined the following fossil shells: they have a common character, distinct from those already described, being lighter coloured, more translucent and granular in texture; *Atrypa extans*, *Leptæna alternata*, and *Orthis pectenella* from the Trenton limestone; *O. erratica* from the Hudson River group, and *Chonetes lata* (?) from the Upper Silurian, besides *Isotelus gigas*, and a species of *Cythere* from the Trenton. All of these consist of carbonate of lime, with only such traces of phosphate as are generally found in calcareous shells.

In the report already quoted we have given a description of some phosphatic bodies which resemble the coprolites of the calciferous sandstone, and are found at Rivière Ouelle in thin layers of a conglomerate limestone, which is interstratified with red and green shales, and belongs to the top of the Hudson River group or the base of the Oneida Conglomerates. The phosphatic masses are very abundant, and rounded, flattened, or cylindrical in shape, and from one-eighth of an inch to an inch in diameter; they sometimes make up the larger part of the conglomerate. Iron pyrites in small globular masses occurs abundantly with them, often filling their interstices, but is not found elsewhere in the rock. These coprolites are finer grained and more compact than those from the Ottawa, and have a conchoidal fracture; their color is bluish or brownish black; the powder is ash-grey, becoming reddish after ignition. They have the hardness of calcite and a density of 3·15. When heated they evolve ammonia with an animal odor, and with sulphuric acid give the reactions of fluorine. The quantitative analysis of one gave—

Phosphate of lime, PO_5, 3Ca O, -	40·34 p. c.
Carbonate of lime, with fluorid, -	5·14
Carbonate of magnesia, - -	9·70
Peroxyd of iron, with a little alumina,	12·62
Oxyd of manganese, - - -	*trace.*
Insoluble silicious residue, - -	25·44
Volatile matter, - - -	2·13
	95·37

The iron exists in part at least as carbonate, and its introduction in so large a quantity, giving color and density to the coprolites, is doubtless connected with the formation of iron pyrites by the de-oxydizing action of organic matters. The production of an equivalent of bisulphuret of iron, from a neutral protosulphate of iron, which alone could exist in contact with limestone, must be attended with the elimination of an equivalent of protoxyd of iron; for $2(SO_3.Fe\ O)—O_7=Fe\ S_2+Fe\ O$.

It is remarkable that no traces of Lingulæ or any other shells have been detected with these coprolites. Thin sections of them are translucent, and under the microscope are seen to consist of a fine granular base, in which are imbedded numerous grains of quartz, and small silicious spiculæ, like those of some sponges. In a bed of sandstone, associated with these conglomerates and slates at Rivière Ouelle, were found several hollow cylindrical bodies, resembling bones in appearance. The longest one is an inch and a half long, and one-fourth of an inch in diameter. It is hollow throughout, and had been entirely filled with the calcareous sandstone, in which it is imbedded, and whose disintegration has left the larger end exposed. The smaller extremity is cylindrical and thin, but it gradually enlarges from a thickening of the walls, and at the other end becomes externally somewhat triangulariform; the cavity remains nearly cylindrical, but the exposed surfaces are rough and irregular within.

The texture of these tubes is compact, their color brownish black with a yellowish brown translucency in thin layers. Analysis shows them to consist, like the coprolites, principally of phosphate of lime. One hundred parts gave—

Phosphate of lime, - - - -	67·53
Carbonate of lime, - - - -	4·35
Magnesia, - - - - -	1·65
Protoxyd of iron, - - - -	2·95
Insoluble silicious sand, - - -	21·10
Volatile, animal matter, - - -	2·15
	99·73

The microscopic examination of a section shows that the walls of the tube are homogeneous, unlike the coprolites, and that the silicious sand in the analysis came from the sandstone which incrusted the rough interior of the fossil. The phosphate is finely granular, and retains no vestige of organic structure. The chemical composition and the remarkable shape of the specimens, however, leave little doubt of their osseous nature, unless we suppose them to be the remains of some hitherto unknown invertebrate animal, whose skeleton, like those of Lingula, Orbicula, and Conularia, consisted of phosphate of lime, a composition hitherto supposed to be peculiar to vertebrate skeletons.

Montreal, January 5th, 1854.

Preliminary Account and Results of the Expedition of Dr. Richard Lepsius to Egypt, Ethiopia, and the Peninsula of Sinai. Scientific Results of the Expedition.*

The scientific results of the expedition have, in almost all respects, surpassed our own expectations. In confirmation of this it will be sufficient briefly to survey these results, which I shall do in the following pages, according to their principal objects, and by entering into some of the details.

The plan of the journey, as a whole, and in its individual parts, was founded principally with a historical purpose in view. The French-Tuscan expedition, compared with ours, was a journey of discovery, with all the advantages, but also with all the disadvantages, connected with such an undertaking. We were able from the commencement to aspire after a certain completeness, within the wide limits that were assigned us, not, however, failing in making new discoveries, which were as important as they were unexpected. The investigation of the most ancient Egyptian times, namely, the epoch of the first Pharaonic monarchy, from about 3900 to 1700 B.C., extending the history of the world almost two thousand years farther back, was left entirely unfathomed by Champollion. He only ascended the Nile valley as far as the second cataract, beyond which existed a great number of Egyptian monuments of all kinds, wholly unexamined, in which we must seek for an explanation of all those Ethiopian antiquities which are inseparable from the Egyptian.

The most important results we obtained, therefore, were in chronology and history. The pyramid-fields of Memphis gave us a notion of the civilization of Egypt in those primitive times, which is pictorially presented to us in 400 large drawings, and will be considered in future as the first section in that portion of the history of man, capable of investigation, and must be regarded with the greatest interest. Those earliest dynasties of Egyptian dominion now afford us more than a barren series of empty, lost, and doubtful names. They are not only free from every real doubt, and arranged in the order and the epochs of time, which have been determined by a critical examination, but by showing us the flourishing condition of the people in those times, both in the affairs of the State, civil affairs, and in the arts, they have received an intellectual and frequently a very individual historical reality. We have already mentioned the discovery of five different burial-places of the sixth dynasty in Central Egypt, and what we obtained from them. The prosperous times of the new monarchy, namely, the period of splendour in the Thebaid, as well as the dynasties which followed, were necessarily more or less completed and verified. Even the Ptolomies, with whom we appear to be perfectly acquainted in the clear narratives of Grecian history, have come forward in a new light through the Egyptian representations and inscriptions, and their deficiencies have been filled up by persons who were hitherto considered doubtful, and were hardly mentioned by the Greeks. Lastly, on the Egyptian monuments we beheld the Roman emperors in still greater and almost unbroken series, in their capacity of Egyptian governors, and they have been carried down since Caracalla, who had hitherto been considered as the last name written in hieroglyphics, through two additional later emperors, as far as Decius, by which means the whole Egyptian monumental history has been extended for a series of years in the other direction.

Egyptian philology has also made considerable progress by this journey. The lexicon has been increased by our becoming acquainted with several hundred signs or groups, and the grammar has received a great many corrections. Such copious materials have also been acquired for these purposes, especially by the numerous paper impressions of the most important inscriptions, that Egyptian philology must be essentially furthered by their being gradually adopted. For, owing to the strict accuracy of these impressions, they are almost as valuable, in many investigations, as an equally large collection of original monuments. In addition to this, the history of the Egyptian language, which, by the great age attributed to the earliest written monuments, embraces a period of time between five or six thousand years, becomes now of much greater importance in the universal history of the human language and writing. Among the individual discoveries we made, the one which attracted most attention was that of the two decrees on the Island of Philæ, which were bilingual, namely, written in hieroglyphics, and in the demotic character—one of which contains the decree belonging to the Rosetta inscription, referring to the wife of Epiphanes.

In spite of numerous writings upon Egyptian mythology, it has nevertheless been hitherto deficient in a fixed monumental basis. In the temple at Thebes we beheld a series of representations whose meaning has not hitherto been recognized, and which seem to me to afford new conclusions for the correct comprehension and development of Egyptian mythology. The series of the first arrangement of the gods mentioned by Herodotus and Manetho, which in modern investigations has been differently arranged in its details by all scholars, is at length placed beyond all doubt, and certainly differs in all essential points from what has been hitherto everywhere adopted. I will briefly allude here to another fact, important both in the history of mythology as well as in a purely historical point of view, and which was elicited by an attentive investigation of the monuments. The direct succession of the reigning royal family was interrupted towards the end of the eighteenth dynasty. Through the monuments we became acquainted with several kings of this period, who were not afterwards admitted in the legitimate lists, but were regarded as unauthorized cotemporary or intermediate kings. Among these, Amenophis 4th is to be particularly noted, who, during a very active reign of twelve years, endeavoured to accomplish a complete reformation of all secular and spiritual institutions. He built a royal capital for himself in Central Egypt near the present Tel-el-Amarna, introduced new offices and usages, and aimed at no less a thing than to abolish the whole religious system of the Egyptians which had hitherto subsisted, and to place in its stead the single worship of the sun. In all the inscriptions composed during his reign, there is not one Egyptian god mentioned except the sun; even in other words the sacred symbols were avoided. Indeed, the former gods and their worship were persecuted to such an extent by this king, that he erased all the gods' names, with the single exception of the sun god Ra, from every monument that was accessible throughout the country. and because his own name, Amenophis, contained the name of Ammon, he changed it into Bech-en-aten, "Worshipper of the Sun's disc." Therefore the fact, which has often been previously remarked, that at one particular period the name of Ammon was intentionally destroyed, forms only part of an event which had a much wider influence, and which unexpectedly reveals to us the religious movements of those times.

The history of art has never yet been considered in the point of view from which Egypt and all that concerns it is now regarded. This necessarily formed a particular object of ourexpedition, and

* Concluding extract from "Letters from Egypt, Ethiopia, and the Peninsula of Sinai." By Dr. Richard Lepsius. Henry G. Bohn, London.

most directly gained by the increased chronological knowledge we obtained concerning the monuments. For the first time we were able to pursue all its branches during the old Egyptian monarchy, previous to the invasion of the Hyksos, and accordingly to extend both it and the history of Egypt about sixteen centuries further back, and some tens of years lower down in time. The different epochs of Egyptian art now first appeared clear and distinct, each marked by its peculiar character, intimately connected with the general development of the people. They had so frequently been misunderstood, that no one believed in their existence; they were lost in the general uniformity. I must mention, as one of the most important facts connected with this, that we found innumerable instances on unfinished monuments of three different canons of proportions of the human body; one belonging to the most ancient Pharaonic monarchy; another later than the twelfth dynasty, when Thebes first began to flourish: a third, which appears at first in the time of the Psammetichi, with an entire alteration in the principle of the division, and which remained unaltered till the time of the Roman emperors. The last is the same which Diodorus expressly mentions in his first book. Among the separate branches of Egyptian art, architecture, which was almost unnoticed by the French-Tuscan expedition, was with us peculiarly attended to, by the extremely careful and circumspect labours of our architect Erbkam. This was befitting the important position occupied by this particular branch, in which grandeur, that element of art, peculiarly belonging to the Egyptian beyond all other nations, was capable of being developed, and has developed itself to the utmost. The study of the sculpture and paintings devolved upon the other artists who accompanied us, and the ability and fidelity with which they fulfilled their tasks must be recognized by every one. The Egyptian style, associated with the limited views characteristic of the infancy of art, nevertheless possesses a highly-cultivated ideal element, which must be acknowledged by every one. The genius of Greece could never have bestowed on art such a marked character, indicative of a period of prosperous liberty, if it had not received it as a severe, chaste, and carefully nurtured child from the Egyptians. The principal task of the history of Egyptian art is to point out wherein consisted this cultivation of art, peculiar to the Egyptians above all the primitive nations of Asia. In the next place, Egyptian archæology, in the widest sense of the word, claimed a large portion of our time and attention, an extensive field, already examined, both successfully and diligently, by Wilkinson and Rosellini, which they were enabled to do by means of the inexhaustible number of separate objects belonging to every-day life, still in preservation, and by the representations of them which arefound in all directions, far surpassing any other ancient remains.

On that account it was still more necessary to make a stricter investigation, and to regard it from a higher point of view, rather than accumulate a greater number of individual things, that, notwithstanding, obtruded themselves on all sides, and which, besides, we collected in large quantities as material to work upon.

Lastly, geography and chorography, which travellers are especially expected to promote, required to be more peculiarly prosecuted. We must particularly mention here, that besides the peculiar investigation of the pyramid-fields at Memphis, and in the Faiûm, which have been already alluded to, our records of the ruins of towns and ancient monuments in the Nile country, as far up as Sennar, are more perfect and exact than any hitherto made. With regard to the modern geographical names, which must always be viewed in comparison with the ancient, I have been most particular in obtaining the Arabic names, at least throughout the district we traversed, in order to counteract, as far as lay in my power, the insufferable confusion in the names which are marked down. During the journey I made special maps for the individual portions of the eastern mountains of Egypt and the peninsula of Sinai, and I collected geographical accounts from travellers concerning some remote districts which we did not enter, and which are but little known; and I had geographical drawings made of them. Our investigations of the historical places in the peninsula of Sinai have already been alluded to. The discovery mentioned above, of the most ancient Nilometer at Semneh has added, in a remarkable degree, also to the history of the physical condition of the Nile valley. Since it is quite evident, from the water just above the second cataract, standing at that time twenty-two feet higher than at present, and the height of the water in the Thebaid being contemporaneously twelve to fifteen feet lower, that the fall of the Nile in the intermediate country was thirty-five feet greater in those times than it is now. But this gradual levelling of the bed of the river must have had the most decided influence on the history of the cultivation of the valley and of the whole population, because the soil on the banks of the river in the district of Nubia, more especially owing to the considerable sinking of the water, being inaccessible to the natural overflowings, was laid dry, and could only be irrigated with great difficulty and imperfectly, by means of artificial water-wheels.

Considerable progress was made in the knowledge of the African languages, by the investigation which I was principally enabled to make in the southern part of our journey. I inquired into and noted down as much of the grammar and vocabulary of three languages as would enable me to give a distinct idea of them. First, Kongara, spoken at Dan-Fûr and the adjacent countries, a central African-Negro language. Secondly, the Nuba language, which is spoken in two chief dialects in one part of the Nubian-Nile valley and in the neighbouring countries situated to the south-west, and also appears to be derived from the interior of Africa. It had never hitherto been a written language, and I collected together for the first time a piece of written Nubian literature, for I made a Nubian sheikh, who was perfectly familiar with the Arabic language and writing, translate the fables of Locman, a portion of the Thousand and One Nights, and the Gospel of St. Mark, from the Arabian into the Nubian tongue, and write down, besides, nineteen Nubian songs, some of of them in rhyme, some only rhythmical, and translate them into Arabic. Unfortunately, these precious packets, all but the Nubian gospel, were lost in Europe, with but little hope of recovery. The third language investigated by me was the Beg'a, which is spoken by the Bischari nation, who dwell between the Red Sea and the Nubian Nile. This language occupies an important position with reference to philology, since it seems to be a branch of the original Asiatic stock, of which the African offsets may be comprehended under the name of the Hamitic languages; and is, besides, particularly interesting in our study of the monuments, because, most probably, it was once the key to decipher the ancient Ethiopian inscriptions, numbers of which were discovered by us upon the Island of Meröe, and from that place in the Nile valley as far down as Philæ. These inscriptions are written in simple characters, from right to left, and derive their origin from the powerful nation of the Meroitic Ethiopians, whose direct descendants we behold in the present Beg'a nations. By comparing those languages with the other languages of Africa, which are already better known, I think I shall be able to separate, according to fixed principles, these "Hamitic languages" of

north and north-east Africa (which may still be referred to their native home in Asia) from the numerous other languages of this enigmatical continent; and I am now engaged in preparing these philological investigations for special publication.

I must finally mention, among the results of our journey, two collections of inscriptions. In the first place, all the Greek inscriptions in the countries we travelled through were carefully sought out, and impressions of them were taken upon paper; by which Græco-Egyptian archæology, and more particularly the learned collections of inscriptions which have lately excited such lively interest, will probably be completed, confirmed, or justified in a satisfactory manner. Secondly, in the peninsula of Sinai we made as perfect a collection as was possible of the so-called Sinaitic Inscriptions, which are found engraved on the rocks in different districts of the peninsula, but principally in the neighbourhood of the old town of Faran, at the foot of the mountain range of Serbal, and at a resting-place of the caravans in Wadi Mokatteb, situated further north, which is named after them.

We were only able casually to turn our attention to objects of natural science. Nevertheless I did not, however, neglect, especially during remote mountainous journeys, to collect specimens of stone and earth from the more remarkable localities. We not only visited the celebrated stone quarries in the chalk mountains of Tura, in the sandstone range of Selseleh, in the granite rocks of Assuan, and others situated in the Nile valley, but also those alabaster quarries of El Bosra, opposite Siut, which were discovered a few years ago by the Bedouins, in which last we found a rock inscription from the commencement of the 17th dynasty. They resemble those quarries of granite and brecciaverde at Hammamat, upon the road leading from Qeneh to the Red Sea, which have been worked from the earliest times, and also the porphyry and granite quarries at Gebel Fatireh (Mons Claudianus) and at Gebel Dochan (Mons Porphyrites), in the Arabian chain of mountains, celebrated in the Roman period. I had also an opportunity of purchasing an interesting ethnographical and natural history collection in Alexandria, obtained by H. Werne during Mohammed Ali's second expedition up the Nile, which penetrated as far as 4° north latitude, of which an account was published; and I received a valuable collection of Egyptian fishes for the Anatomical Museum in Berlin, from the celebrated French physician, Clot Bey.

On some new Genera and Species of Cystidea from the Trenton Limestone.

By E. Billings, Barrister at Law, Bytown, Canada West.

SECOND PAPER.

Read before the Canadian Institute, April 8th, 1854.

GENUS COMAROCYSTITES.

When deeply imbedded in the rock, and without the column, arms, or ovarian aperture being visible, the fossil for which the above generic name is proposed, might, upon a superficial examination, be readily mistaken for a coral. When entirely separated from the matrix, and not compressed, or otherwise distorted, it has the form and general appearance of a large strawberry.

It is of an oval shape, the smaller end being the base where the stem is attached, and the larger extremity the summit, in the centre of which is situated the elongated mouth. Two very young specimens are each about three quarters of an inch in length, and a large one pressed quite flat and lying embedded in the rock about two inches. The whole surface is covered over with hexagonal or pentagonal pits rounded at the bottom, each one of which marks the area of a concave or deeply depressed plate.

Upon the upper joint of the column stand three low but broad pentagonal plates, with serrated edges above. These form a narrow circular pelvis, and are so closely united at their sides that it is difficult to detect the lines of division between them. There are generally two rows of small irregular plates varying in size and number, in different specimens, between the pelvis and the commencement of the regular hexagonal plates.

Resting on two of the small plates on the ovarian side is the base of an upright row of four large ones, the lowest of which is heptagonal, the two next six-sided, and the fourth pentagonal. From the pointed apex of the latter the suture between two others proceeds to the lower side of the ovarian aperture. This arrangement is well marked in all the individuals in which the posterior side remains entire. It may therefore be regarded as a permanent character of the genus. A line drawn from the centre of the base upwards along these four plates, through the centre of the ovarial orifice, between the two arms hereafter to be described, and through the mouth to the opposite side of the summit, and thence to the base on the anterior side, would divide the fossil into two equal parts. It appears thus to have had a bilateral symmetry.

From each side of this upright column of plates on the ovarian side the principal plates of the body run round the fossil in rows nearly horizontal. There are from eight to eleven of those rows, including the pelvic series.

Near the summit is an opening closed by a valvular apparatus of five or six triangular plates—probably the ovarian aperture. In the specimen (Fig. 3) it is obtusely pentagonal, and three-sixteenths of an inch in diameter. In several other specimens there are six ovarian valves, but in this there are apparently only five. They all meet in the centre of the orifice and project a little outwards, so as to form a low dome-shaped prominence, through the apex of which there is a small perforation, which seems to be formed by the truncation of the apices of all the plates. This perforation is not visible in the two specimens figured, because in these the upper portions of the plates are in a mutilated condition in this particular part, but in several others not so perfect, in other respects, it can be seen.

A similar provision is described as forming a feature of the reproductive organ in several of the already known species of Cystidæ. Of *Spheronites* Von Buch states, "Lower down, but on the same hemisphere with the mouth, occurs a large pyramidal orifice, closed with five or more, rarely six valves, which is the ovarial opening; on the top of each of these valves is a small orifice piercing quite through the valve, and possibly the eggs were extruded from these orifices, since the valves themselves are never found open." (Quart. Jour. Geo. Soc., Vol. 2, page 30.) At page 39 in the same article in his description of *Cryptocrinites cerasus*, he says, "The mouth is proboscidiform, and covered with very small plates. The ovarial orifice is covered with five small valves, rarely preserved, arranged like a star, and in each of the valves is a small orifice open to the interior of the plates, as in *Spheronites*, but situated exactly in the middle of the valve, and probably serving for the protrusion of the eggs." Professor Hall has also figured this small orifice in the ovarian pyramid of *Apiocystites elegans*. (Pal. N. Y. Vol. 2, Plate 51, Fig. 13.)

Our fossil is closely allied to *Spheronites*, which are nearly spherical cystideans covered like this by a great number of plates, with the mouth also situated on the summit, and the ovarian

aperture a little below. That genus, however, was unprovided with arms, and had six plates in the pelvis. In this there are but three plates in the pelvis, and besides it bears upon its summit certainly three, if not four, long tentaculated arms. In other respects it is nothing more than an elongated *Spheronite.*

The arms are each composed of a single series of large oblong joints loosely articulated upon each other. From each joint proceeds one long nearly cylindrical tentaculum, also composed of a single series of short joints. The large specimen, fig. 3, is deeply buried in a piece of limestone, and as only one side of the arm is above the surface, it cannot be determined whether another row of tentacula exists on the other side of it or not.

The tentacula are not perfectly cylindrical, but compressed to a sharp edge on one side, and on each side of this ridge a row of obscurely visible pits extends the whole length, as if here an appendage of some kind had been fastened.

The other specimen (Fig. 1) is detached from the matrix, and preserves its form, with the exception of a very slight compression. The summit shows the bases of three arms. Two of these are placed close together on the edge of the summit immediately over the ovarian aperture, and the other upon the side opposite. The summit is not circular, but elliptical, the pair of arms standing at one end of the ellipse and the single arm at the other.

Professor Forbes has figured three Cystideans from the Bala limestone of Shole's Hook and Reulas, with protuberances upon their summits very like the bases of the arms remaining on several specimens of this species. Of two of these, of the same species, *Caryocystites munitus*, he says, "They are both globular bodies, nearly smooth, except for the markings referred to, and especially distinguished by their summits being crowned with four tubercles, connected together by ridges, so as to form, as it were, a turretted wall and square fortification around the mouth." (Memoirs of the Geological Survey of England, Vol. 2, part 2, page 515, and plate 21.) The appearances exhibited by the fossils found here, when compared with Professor Forbes's figures, strongly induce the suspicion that some of the English Cystideæ were also provided with free arms.

It may be observed here that Von Buch was of opinion that the Cystidea were totally destitute of arms. Voborth supported the opposite view, and contended that they not only had arms like the Crinoidea, but that they were in fact true Crinoids. Afterwards several species were discovered with flattened appendages, which were turned downwards from the summit and attached to the sides, as in *Glyptocystites multipora.* Another, *Prunocystites Fletcheri*, was found at Dudley, in England, with the remains of several long tentacula, like those of the genus *Pleurocystites.* Professor Forbes describes it as "a small ovate cystidean, with a very large stem attached, and presenting the remarkable feature of possessing long tentacula, or filamentary arms, not folded back and lodged in grooves, as in the *Pseudocrinites* and its allies, but projecting directly from the oral aperture, around which they appear to have been attached. . . . They appear to be analagous to the fingers and not the arms of *Pseudocrinites.*" (Mem. Geo. Sur., page 503 and 504.) The specimen (fig. 3) is probably the first ever discovered with a true tentaculated arm rising free from the summit. It is not, however, on account of its being furnished with free arms, a Crinoid. In animals of this latter order the ovaries are said to have been borne aloft upon the arms and the eggs protected by the tentacula until the proper time arrived for casting them off; but in the Cystidea the organs of reproduction, according to the opinions of many of the best naturalists, open out to the exterior through the large aperture in the side beneath the summit.

It has been stated that the summit of this fossil is elliptical, and that a pair of arms stands at one end of the ellipse, and a single arm at the other. From the single arm a deep groove now filled with dark calcareous matter is seen in the specimen (Fig. 1) to extend to a point between the other two. This is without doubt the mouth. It follows the major axis of the ellipse, and is therefore elongated in an anterior and posterior direction, that is to say, it extends from a point directly over the ovarian aperture straight across the summit to the opposite or anterior side. There is some evidence to show that from the ends of the mouth grooves extend up the arms on the inside, as in the Crinoids; but the specimens are not sufficiently cleared of the matrix to determine this point with certainty. Neither do they show positively that in any case there were only three arms. It appears to me that there must have been a pair at each end of the mouth, and that in some instances one of them has either been removed or cannot be seen. In the large specimen figured the arm is well preserved, but the upper part above the ninth joint is buried in the stone, so that its length cannot be determined.

On the right of the summit of the specimen Fig. 3 the impression of the other arm of the pair remains. These two arms appear to be placed further apart than in some other specimens.

The column is round, and composed of thin joints, so that it is nearly smooth, or only surrounded by very small rings close to each other.

Many specimens of this fossil in a more or less fragmentary condition, have been found by different persons within the last few years in the Trenton limestone of this locality, generally along the water's edge from the Rideau falls to the Chaudière. As neither the pelvis nor arms were preserved in any of these that came within my observation, I always supposed them to be portions of a new species of *Spheronites*, judging from the great number of plates. At length, in the month of June last, I had the good fortune to discover the magnificent specimen (Fig. 3) in a place where it is strange that it had not been previously detected. A large picnic party once assembled on this spot, and, as I am informed, the gentlemen and ladies danced upon the level surface of the limestone rock without discovering the sleeping form of this ancient inhabitant of the old Silurian ocean. This was ten years ago, and it is possible that during the period which elapsed the fossil became more exposed by the weathering of the matrix. During the last autumn I collected several others, not so perfect, but exhibiting parts not exposed in this specimen. Fig. 1 was found in the month of November last, by Mr. W. S. Hunter of this place, from whom I procured it. Nearly all the specimens that I have seen are unquestionably of the same species as this Fig. 1, and I have therefore selected it as the typical form. From its shape and the appearance of its surface, I beg to suggest as a name for the genus, *Comarocystites*, from the Greek *κόμᾰρον*—a strawberry. Its characters may be concisely summed up as follows:—

GENUS COMAROCYSTITES.

(Greek *κομαρον*, *arbutum*, and *κυστις*, *vesica.*)

Body ovate, the smaller extremity being the base, pelvis small. of three plates, above which are from eight to eleven rows of plates, mostly hexagonal, ovarian aperture near the summit, closed by a valvular apparatus, mouth apical, arms free, composed of a single series of joints and bearing tentacula, column round.

Comarocystites punctuatus.

Fig. 1.

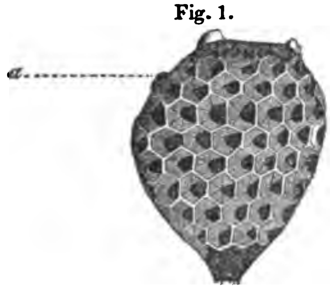


Fig. 2.

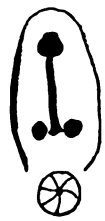


Fig. 3.

Fig. 1. *Side view of a specimen separated from the matrix. a—position of the ovarian aperture.*

Fig. 2. *The summit showing the direction of the supposed mouth with respect to the ovarian aperture.*

Fig. 3. *A large specimen of Comarocystites punctuatus, retaining an arm and several tentacula. The dotted lines on the right show the impression of another arm. The plates of the ovarian aperture are restored in the figure. They are shattered in the specimen.*

The general form of this species is somewhat oval, projecting largely on the ovarian side. Its greatest expansion is near the summit, whence it tapers to a point at the base of the diameter of the column or a little longer. The plates are deeply depressed in the centre, and thus the whole surface is covered with almost hemispherical pits, except near the base, where the small plates are but slightly concave. The surfaces of the plates are covered with small oblong punctuations. If lines be drawn from the centre of each plate to each of its angles, they will divide it into as many triangular spaces as it has sides. All the oblong punctuations in each of those spaces will be found parallel with each other, but not with those of the adjoining spaces. They are arranged in rows parallel to the edges of the plate, and the greatest axis of each pore is at right angles to the suture. In this respect they correspond to the striation usually seen on the plates of the Cystidæ, which generally cross the sutures at right angles from the centre of one plate to that of another. They do not penetrate but to a short distance below the surface, and when the plates are weather-worn they disappear altogether. On each of the ridges which mark the positions of the sutures between the plates, there is a single row of those pores which penetrate deeper, and are seen after they have been worn away from the interior of the plates. Nearly all the specimens have this character of surface. In the large one, however (Fig. 3), a small space in the depressed centres of each plate is smooth, and from the border of this space lammellar ridges cross over to the adjoining plate. These ridges are divided by other ridges crossing them parallel with the sutures. The effect produced is nearly the same. Near the ovarian aperture, also, in this specimen, from the bottom of each of several of the cavities arises a rough tubercle to the height of the surrounding ridges. Other individuals differ slightly in their surface markings, but perhaps only sufficient to constitute varieties. The specimen, Fig. 3, is crushed, and does not exhibit the true natural shape. A very large specimen pressed quite flat, and lying on a slab of limestone, has a portion of the upper side removed, so that the interior surface of the side below can be seen. The plates are thus found to be on their inside elevated in the centre, and covered with strong rounded ridges, radiating to the centres of the sides. They do not extend to the centres of the plates, but cross the furrows made on the inside by the elevation of the borders of the plates on the outside. The pelvic plates are low, broad and serrated on their upper sides. They are so firmly united to the upper joint of the column and to each other, that it is difficult to detect the division lines between them.

GENUS AMYGDALOCYSTITES.

This very curious and beautiful Cystidean differs from the former principally in the manner in which the arms are constructed. They are not free or springing upwards like the arms of a Crinoid, but consist of a short row of calcareous joints crossing the summit, and extending a short distance down the sides. From each of these joints a long tentacle arises, similar to those of the last species. As the specimens are deeply embedded in the rock, very little can be said about them at present The most perfect, Fig. 4, much resembles an almond, and I therefore propose for it the generic name *Amygdalocystites*. Its characters, so far as they can be determined, are as follows:—

Body ovate, pelvis of three (?) plates, above which are eight or more rows of plates, completing the cup, ovarian aperture near the summit, closed by a valvular apparatus, arms composed of a row of joints crossing the summit and articulated to the surface, each joint bears a tentacle, column round and of thin joints, mouth unknown.

Amygdalocystites florealis.

Fig. 4.

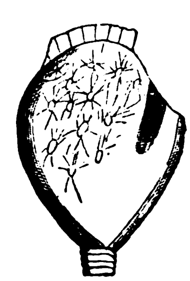


Fig. 5.

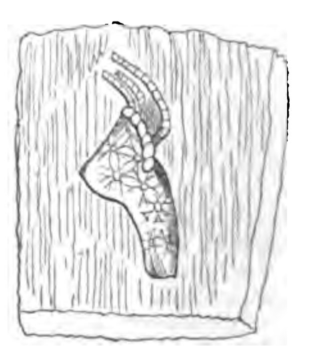


Fig. 6.

Fig. 4. *A specimen with a part of the arm, ovarian aperture, and four joints of the column. Surface character of the plates not well preserved.*

Fig. 5. *A fragment from the same slab, showing the markings of the plates and three of the tentacula.*

Fig. 6. *A single plate.*

In this species a low rounded tubercle is situated in the centre of each plate, from which ridges radiate to the angles. These ridges are scarcely elevated above the surface, where they leave the border of the tubercle in the centre of the plate, but increase in width and height as they depart from it. They are sharp above, and attain their greatest elevation at the angle of the plate. The ovarian aperture is situated close to the arm near the summit, and appears to be formed of six triangular plates. The short fragment of the column which remains is composed of four joints about the sixteenth of an inch in thickness. The fragment, Fig. 5, shows the form of the plates and three of the tentacula attached to the arm. The remainder of the specimen is concealed.

Amygdalocystites radiatus.

Fig. 7.

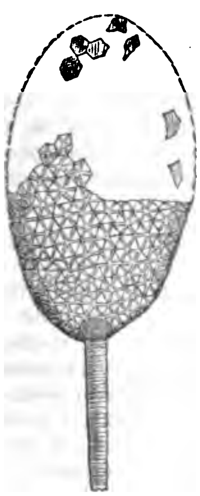


Fig. 8.

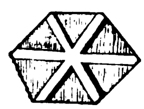


Fig. 7. *Part of the body and column of a specimen.*

Fig. 8. *A plate enlarged.*

This specimen consists of the lower part of the cup, and about one inch in length of the column of a Cystidean, which will probably be found to belong to the same genus as the last. The plates are somewhat convex exteriorly, and ornamented with strong rays, which extend from the centre to the angles. At the base a large six-sided pelvic plate is seen resting on the column. From the width of this plate in proportion to the size of the column, it appears that the pelvis is formed of three plates. The column is round and smooth. The impression upon the stone shows that this individual was of the size indicated by the dotted line in the figure.

Amygdalocystites tenuistriatus.

Fig. 9.

Fig. 9. *A specimen separated from the matrix, but crushed quite flat, and broken into three pieces. a—the ovarian aperture.*

Of this species I have only the single specimen figured. The plates are elevated and smooth in the centre. A low rounded ridge proceeds from the smooth space to each angle. Between these ridges fine striæ cross from one plate to the other, at right angles to the sutures. The pelvis consists of three broad pentagonal plates. The column is round, and formed of very thin plates. The ovarian aperture is nearly on the top of the summit. Neither arms nor mouth have been observed. The specimen is separated from the matrix, but crushed quite flat, and broken across in two places.

These three last described species appear all to belong to a genus different from *Comarocystites*, and I have therefore disposed of them as above, provisionally. When more becomes known about them, it may be necessary to make another arrangement.

Agelacrinites.

Fig. 10.

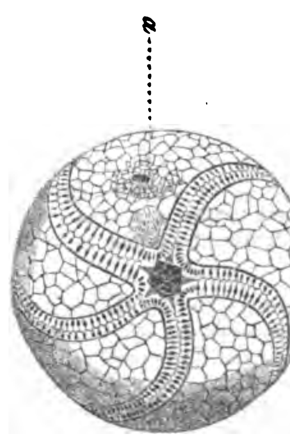


Fig. 11.

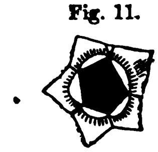


Fig. 12.

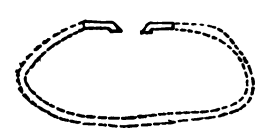


Fig. 10. *Partly restored figure of Agelacrinite from the Trenton limetone, Bytown. a—supposed ovarian aperture.*

Fig. 11. *Plates surrounding the mouth, under side. These plates have all an elevated border on the side next the mouth, below, caused by the bending down of the plate, as seen in* Fig. 12.

Fig. 12. *Vertical section through the mouth.*

This genus has been long known in Europe by a single specimen discovered about thirty years ago at the Chaudière Falls in

this vicinity, by Dr. Bigsby, and by him taken to England. Another specimen was found by Mr. Gibbs (of the Geological Survey of England), near Yspetty Evan, in North Wales, in a mass of schistose rock, from a quarry associated with the Bala limestone, a formation which has furnished many species of Cystidea, and which appears to occupy the same palaeontological level as the Trenton limestone. In describing the last mentioned specimen Professor Forbes states:—

"One of the most remarkable Cystideans as yet discovered in British strata is a fossil which rewarded the exertions of the collectors for the Survey in North Wales during the summer of 1847. It is a hemispherical, many plated, spheronite-like body, but presenting the striking characteristic of possessing five serpentine grooves, radiating from its mouth, and occupied by as many appressed arms. Within one of the compartments formed by the surrounding arms is an ovarian pyramid. Thus it exhibits characters which in some degree link the very different types, *Pseudocrinites* and *Spheronites*.

"Although no similar European form had been described by any author, its aspect immediately called to mind a remarkable American fossil, figured and described by Mr. G. B. Sowerby, in the second volume of the Zoological Journal." The body in question was discovered by Dr. Bigsby in Canada, and Mr. Sowerby describes it as follows:—

"Upon examination of this fossil, we do not immediately recognise its affinities, for it bears so near a resemblance to the arms of an Asterias lying on an Echinus; we think, however, judging from the want of ambulacra, that it would be properly placed among the genera of the *Asteriadæ*. At the same time, its vicinity in general form to Say's family of *Blastoidea* renders it doubtful whether it ought not to be considered as a connecting link to be placed between the two families of *Crinoidea* and *Blastoidea*, and this suggestion obtains support from the apparently lateral situation of the mouth, in which it resembles some of the *Crinoidea*. This suggestion, however, involves the following consideration, namely, whether those rays in the *Blastoidea*, which, by Say, are called *ambulacra* (a term commonly applied to an apparently corresponding part in the Echinida), really serve the same purpose, or whether they be not arms, as in the other *Crinoidea*. And I venture to assert that there is nothing, either in their position or form, that militates against such an idea.

"I hope the following description, together with the figure by which it will be accompanied, will serve to give as correct an idea of the fossil in question as can be conveyed without the actual examination of the specimen.

"The general form, as far as we can judge from the specimen, in which none of the lower part is preserved, is a depressed spheroid, and it does not appear to have naturally any angular prominences, though, owing to the circumstance of its being divided into five sections, it might possibly be very obtusely pentagonal. It appears to have consisted of a number of irregular partly imbricated, crustaceous plates, and its upper half is divided into five sections or compartments, by five equal arms, which diverge from the centre, and are curved all in the same direction.

"The compartments are not equal in size; in the largest of them, and near its centre, is placed the mouth, which appears to have been surrounded by two or three rows of very minute, imbricated, crustaceous scales; the arms, five in number, all diminishing to a point at their outer extremity, and having their upper portion elevated above the body, seem, however, to be attached to it by their under side, and indeed partly bedded in it; each one is divided into two equal parts by a longitudinal groove, and each of these parts is again divided into a number of segments by transverse and deep grooves, which are close set, being about half their length distant from each other. I cannot ascertain whether there is any natural opening in the centre or not. The whole is changed into crystalline carbonate of lime, coloured by iron rust, and it lies upon a mass of limestone, containing a mass of Encrini and Madreporites; a single spiral univalve is also to be observed. From the Falls of the Chaudiere on the Ottawa River in Lower Canada."

In reference to these remarks of Mr. Sowerby, Professor Forbes observes:—

"Although the true affinities of this curious fossil are not recognised in this description, and many of the parts misinterpreted (as, for example, the ovarian pyramid is regarded as the mouth), still there can be no question, especially when the characteristic figure which accompanies the paper is examined, of its true position being among the Cystideans, and of its being generically allied to the British fossil we are about to describe."—*Mem. Geo. Sur.*, Vol. I., p. 519.

In one locality near Bytown in the Trenton limestone I found seven specimens of the fossil above described by Mr. Sowerby lying near each other, within a space of four square yards in extent, and partially imbedded in the surface of a stratum of limestone. Along with them were three new species of encrinites, the Cystidean last described, several trilobites, and a great quantity of the coral *Chetetes lycoperdon*. I succeeded in clearing from the matrix one specimen, consisting of three of the rays and four sides of the mouth, so that both sides of the shell can be seen.

It shows an important character not previously observed, and which appears to affect the zoological rank of the fossil very materially. The rays are not grooves for the reception of arms, as has been supposed, but appear to be ambulacra, resembling those of the *Echinidæ*.

They are composed each of two rows of oblong pentagonal plates, and are perforated between the joints by two single rows of very large pores, which open out on the interior in the same manner as on the exterior. The mouth is large and five-sided, as shown in the figure. The supposed ovarian aperture consists of a space between two of the rays, covered by a number of plates much smaller than the average size. They form an elevation, the apex of which has been shattered, so that it cannot be determined whether there was in this place an ovarian pyramid or not. This part is only preserved in one of my specimens, and it is from this that I have drawn the corresponding part in the figure. Another specimen shows the plates on the other side except in the centre, where there appears to have been a round opening three-eighths of an inch in diameter. It is much distorted, however, and the plates are obscurely seen, so that nothing can be asserted concerning it with certainty. In this one, also, it is remarkable that the rays turn to the right instead of the left, as in all the others.

The figure given above is a restoration, showing the structure of the fossil, as seen in the specimens in my possession, one of which is nearly as perfect as the figure itself.

All the appearances about this fossil negative the idea that these grooved rays were occupied by arms.

The grooves for the reception of the brachial appendages in the *Cystideæ* are shallow excavations in the surface of the regular plates of the body, and in *Glyptocystites multipora*, when the arms are removed, it would not be suspected from any indication remaining after the specimen has been slightly worn that they had ever existed. In this fossil, however, the radial furrows, supposed to be the grooves for arms, are formed of an arrangement of special plates, which constitute at the same time a part of the general covering of the body.

True arms have an ambulacral and an antambulacral side.* If the latter were placed downwards, resting on the bottom of the grooves, as is the position of the arms in the genera *Pseudocrinites*, *Glyptocystites* and others, then it would close all those pores in the rays, and they would be useless. But if, on the other hand, the ambulacral side of the arm be placed downwards, then all its own pores, if any, would either be closed or else open only into the interior of the body through the apertures of the grooves beneath.

Neither do those apertures in the rays appear to have been the openings of alimentary canals for the nourishment of rows of tentacula placed on the rays, like the tentacula which fringe the borders of the pseudambulacral-fields of the Pentremites. Their great size seems to preclude this idea, and again on the under side of the ray there are no traces of that peculiar tubular or reed-like apparatus (*Rohren Apparate*), described by Roemer as existing beneath the pseudambulacra.†

Each ray terminates at the mouth in a single plate, which forms one side of the mouth. When viewed from the under side these five terminal plates are seen to be pentagonal, and touch each other, as seen in Fig. 11. But on the upper side the sutures between them are concealed beneath five other plates placed upon them, and which form five elevated corners at the angles of the mouth. The pores which, in the rays beyond those plates, make their way between the joints, here seem to penetrate through the margins of the upper terminal plates, and one exactly over the corner of the mouth is larger than the others. In the body of the rays the pores can be clearly seen on the underside, but I cannot ascertain whether those on the upper series of the ten oral plates penetrate to the interior or not.

When these new characters are compared with those of *Agelacrinites*, the fossil certainly seems to constitute a different genus. Professor Hall defines the genus *Hemicystites* as follows:—

"Body circular, depressed at the margins, centre elevated, composed of an unequal number of imbricating plates; arms five, adhering, radiating from the centre, and composed of a double series of alternating joints; an ovarian orifice closed by triangular plates; an oral and an anal orifice, with a porous tubercle near the apex." Pal. N. Y. Vol. 2, page 245. He afterwards says in a note at page 355 of the same work, "This genus is apparently identical with *Agelacrinites* of *Vanuxem*, the description and figure of which I had overlooked at the time this volume was written."

If we take the above description of the genus *Hemicystites* as a definition of *Agelacrinites*, then the fossil now under consideration cannot readily be determined to be a species of the latter genus. The difference in the position of the mouth in the two is quite sufficient to separate them. In our specimen, the rays proceed as it were out of the mouth, whereas in *Agelacrinites* the mouth is situated on one side of the apex in one of the spaces between two of the rays.

It may be that *Agelacrinites* is the young of this species. About six years ago, I found a fossil almost exactly like that figured by Vanuxem, and last summer on the same spot a fragment of one of the rays of a specimen of this large kind. In the fall of 1852, I discovered another, also like Vanuxem's fossil, on a stratum of limestone, which projected from beneath another, and last spring, on returning to the place and removing the upper layer, and about three inches of shale, the seven specimens above mentioned were disclosed, with a prodigious number of fossils of other species.

Neither of the small specimens are in my possession, but judging from Vanuxem's figure and Professor Hall's description of *Hemicystites*, and also from recollection of the structure of the fossils, I have no doubt but that they are *Agelacrinites*. If so, then the circumstance of their having been found in two instances in association with the larger organisms, points to the conclusion that they are the young of the latter. *Agelacrinites* may therefore be, as Professor Hall has suggested, "the embryonic condition of a higher organization."

If we regard these two forms found here as distinct species of Cystidea, then there are certainly twelve species of this extinct order imbedded in the Trenton limestone in this locality, for besides those described in these two papers, there are the fragments of two others. One of these I have often met with in detached plates, containing half of a pectinated rhomb, and of the other I have a fragment of one side, consisting of about twenty plates. That they are parts of Cystideans there can be no doubt.

There are also several specimens of *Pleurocystites*, which appear to be different from those described in the first paper.

These new fossils were all discovered in the upper one hundred feet of the Trenton limestone, associated with between twenty-five and thirty new species of Crinoids, some of them beautiful forms. They belong principally to the genera *Heterocrinus*, *Glyptocrinus*, *Homocrinus*, *Lecanocrinus*, *Thysanocrinus*, and two or three new genera. The heads are mostly crushed, but sufficiently perfect to make out the form and arrangement of plates. It will be no doubt useful to those examining the rocks of the Ottawa, to know that nearly all the smooth round columns of Crinoidea, so abundant, may be referred to two fine species of *Thysanocrinus*. This encrinite has a branching root and a round, smooth, straight column, which, for a few inches below the head, becomes annulated by alternately larger and smaller joints, as shown in the fragment of the stem seen attached to the figure of *T. Liliformis*, in the 2d volume of the Palæontology of New York, Plate 42.

Nearly all the large moniliform columns are those of several magnificent species of Glyptocrinus, of which I have the heads. I believe that the discovery of two species of *Lecanocrinus* is the first appearance in our strata of Crinoids, with three plates only in the pelvis, so low down in the series as the Trenton limestone. These I found during the month of November last.

The Cystidea described in these two papers, although different even in genus, when viewed altogether as a group, resemble those

* "Arms are free radii with an ambulacral and antambulacral side." J. Muller. On the Structure of the Echinoderms. Annals of Natural History, January, 1854, page 8.

† See Roemer. Monographie der Fossilen Crinoiden familie der Blastoideen und der Gattung Pentatrematites im besondern; page 19, Taf. I., 2, 6.

of the Bala limestone and the Lower Silurian of Russia and Norway. Thus *Pleurocystites* is in general appearance like *Hemicosmites; Comarocystites*, and *Amygdalocystites*, closely resemble *Spheronites*, while our large supposed *Agelacrinite* is almost identical with *A. Buchianus* of the Geological Survey of England from the Bala limestone. In its open ovarian aperture and in the form of its pectinated rhombs, the genus *Glyptocystites* is similar to the Russian *Echino-encrinites*, but widely different from that group of species of the latter genus found in the upper Silurian rocks of Dudley.

The Bala limestone seems to be the equivalent of the upper part of the Trenton formation, judging from the general aspect of the Cystidea and the numbers in which they have been found. There is thus near the base of the lower Silurian a Cystidean zone which has been traced half round the world from Upper Canada to St. Petersburg.

That these two formations (the Bala limestone and the upper part of the Trenton) lie in the same geological horizon, is further borne out by other fossils.

At Knockdollian, in Ayrshire, Scotland, in rocks which Professor Sedgwick places in the lower Bala, and therefore below the Bala limestone, great numbers of *Maclurea magna* are found together with *Murchisonia angustata*. At Aldeans (also lower Bala) *Macluera magna*, and, it would appear, *M. Loganii* occur. On the Ottawa both these fossils are found occupying the same position immediately below the beds of Cystidea, as they do in Europe.

When we consider the restricted vertical range of *M. Magna* everywhere in America, it is not likely that in Europe it should be found in another formation, and it is therefore highly probable that the Scottish Silurians in which it occurs are the equivalents of the Chazy, Birdseye, Black river, and the lower part of the Trenton.*

On some Points connected with the Early History of Rome.

By the Rev. E. St. John Parry, M.A., Professor of Classics, University of Trinity College, Toronto.

Continued from page 219.

On the Italian Languages.†

In the former part of this paper I considered some questions connected with the ethnology of Ancient Italy. We found the area of the peninsula originally occupied by Umbrians and Opicans, combined in different degrees with Pelasgians from the north-east. In Etruria these Pelasgians had established themselves as a distinct nation, in possession of an empire which the Umbrians could never throw off. In Latium, also, another family of Pelasgians had settled themselves; while a mixed population of Oscans and Pelasgians extended to the very south of Italy. Thus, independently of a Keltic substratum—which has been with much reason assumed—we have this admixture or juxtaposition of Umbro-Oscan and Tyrrheno-Pelasgian tribes constituting the population of ancient Italy. At the early dawn of history we saw foreign tribes gaining a footing in Italy on the north and the south; on the north the Rhætian tribe of Rasena or proper Etruscans; on the south, the maritime colonies of ancient Greece. And at this period of Etruscan invasion, we found a young state on the banks of the Tiber, which, together with the rest of the Latin name, after a period of humiliation, succeeded in driving back the tide of Etruscan invasion beyond the banks of the Tiber.†

We now pass to a consideration of the languages of ancient Italy, and of the earliest form of the Latin language, as an immediate compound of Umbrian, Oscan, and Etruscan elements. Latin is above all ancient languages a composite of many discordant elements. The philologer traces in it remains of an old Keltic element on the one hand, exhibiting itself in the Umbrian language, as preserved to us through the *Eugubine Tables*. The connection between these fragments and even our modern Keltic languages is so striking, that Professor Newman has considered himself justified in claiming the old Umbrian as a member of the general Keltic stock, or rather, to use his own words, "in extending the term Keltic so as to embrace this Italian tribe." (*Regal Rome*, p. 17.) The connection between the old Latin and the modern Gaelic is well shown by a comparison of their vocabularies, as instituted by Newman. (*Regal Rome*, pp. 19, 20, 61, &c.) An examination of the ancient Umbrian and Sabine words exhibits many striking points of resemblance to the corresponding words now in use in Welsh and Gaelic tribes: and it is, moreover, stated, as the result of a careful study of the affinities of these languages, that the words thus connected, while occupying in Latin an isolated position, appear in the Gaelic languages in the midst of cognate families. These considerations tend to show us that in one element of the Latin language, derived from the Umbrian population, we recognise a member of the same widely-spread Keltic tongue, which is still in use in Wales, Scotland, and Ireland. One point in Professor Newman's classification may admit of a doubt. He considers the Sabine language as generically identical with the Umbrian. No doubt the Sabine people were originally an Umbrian race, but yet we find them, at a later period, certainly as distinct from the Umbrian nation in general, as from the Oscans and Latins on the other hand. These Sabine conquerors, by a not uncommon fate, received their language from the conquered Ausonians; and the union of these two tribes is philologically represented by the Sabello-Oscan language, as preserved in the *Bantine Table*, the *Cippus Abellanus*, and the bronze tablet of *Agnone*. While, then, we admit the original affinity of the Umbrian and Oscan nations, we must be careful, at the same time, to recognize the historical existence of a secondary nation, formed by the agglutination of the Sabellians and the Oscans. It is a remarkable fact that no strictly-called Sabine inscriptions exist: all the individual words claimed as Sabine, with a very few exceptions, being found in the Oscan inscriptions. These facts will justify

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* See British Palæozoic Rocks, Sedgwick and M'Coy. List of Fossils, page 851; and Quart. Jour. Geo. Soc., vol. 7, page 176.

† In preparing this part of my paper for the Canadian Journal, I found that it would be necessary, in order to do justice to the question, to enter more fully into the details of the early Italian languages than I had been able to do in a short lecture. The publication of these pages has been delayed in consequence of unavoidable engagements.

† See Donaldson's "Varronianus," ch. 1, §10. In revising this part of my Lecture, I have had the advantage of consulting the "Varronianus," which contains abundant materials for the discussion of the interesting questions connected with the early nations and languages of Italy. It is gratifying to find that the views which I had independently put forward, in confirmation of Niebuhr's hypothesis of the relation of the Rasena to the Gothic family, are maintained by such an authority as Dr. Donaldson.

us in treating the Sabello-Oscan as a separate language from the Umbrian, though not on the same level with it, as a pure specimen of an original Italian tongue. (See *Varronianus,* chapter IV., § 1.)

Again, in the Roman language, we find many traces of an element derived from Etruria, and exhibiting a direct connection with Pelasgic idiom on the one side, and on the other with the oldest Low German or Scandinavian dialects. This is a part of our inquiry which will be attended with especial difficulty, in consequence of the imperfect state of Etruscan philology, and the deficiency of materials upon which to base a general conclusion with any likelihood of complete truth.

Lastly, we have still preserved to us some interesting remains of the old Roman language—the offspring of the Umbrian, Oscan, and Tuscan—as it was in its rude youth, before the influence of Greek literature had melted down the rugged *Saturnian* verse into the flowing cadence of the Homeric *hexameter.* Macaulay, in his preface to his exquisite *Lays of Ancient Rome,* has shown how the old literature was extinguished under the growing prevalence of foreign fashions. The consequence is, that our preserved remains of genuine early Roman records are but scanty, and relate chiefly to religion and law. The language of the Scipios, as exhibited in a series of famous epitaphs, differs but little from the classical style of the Augustan age, and shows that we are drawing near to a period when the conquered Greek had re-conquered his savage conqueror; and the triumph of Athenian verse and Athenian art had showed that Greece was still to rule the mind of the world, though the Roman sword might hew its way to a grander empire than Pericles had ever dreamed.

It will be interesting to examine in detail some specimens of each of the component elements of the Latin language, as well as of the earliest form of the Roman language itself. Such an investigation will enable us to trace the affinities of the present classical Latin language; while, at the same time, we shall obtain some insight into the civil and religious character of those ancient tribes from whom sprung the conquerors of the world—the ancestors of Cicero, Virgil, and Livy; of Scipio, Cæsar, and Pompey.

I. The Umbrian Language.

The Eugubine Tables, which present us with a specimen of the old Umbrian language, were discovered in the year 1444 in the neighbourhood of Gubbio (the ancient Iguvium). On the mountain which rose above the city stood the temple of Jupiter Appenninus—whence the city derives its name: Iguvium, *Umbrian* Jiovium = Jovium = Δῖον, Δῖος πόλις. The Tables relate chiefly to matters of religion. The elucidation of these memorials of this indigenous Italian language is due to the exertions of Lepsius, Lassen, Aufrecht, and Kirchoff, from whom the chapter in Donaldson's *Varronianus* is mainly compiled. Within our present limits we must content ourselves with a brief selection, suited to show some of the characteristics of the Umbrian language. The following passage is taken from the first Eugubine Table, as quoted by Donaldson, who supplies the translation of the original into Latin:—

Umbrian Inscription.	*Latin Translation.*
Tab. 1, a.	
2. Pre-veres treplanes,	2. Ante portam Treblanam
3. Juve Krapuvi tre [f] buf fetie, arvia ustentu,	3. Jovi Grabovio tres boves facito, arvinâ ostendito,
4. Vatuva ferine feitu, heris vinu, heri [s] puni,	4. Fatuâ farinâ facito, vel vino, vel pane,
5. Ukriper Fisiu, tutaper Ikuvina, feitu sevum,	5. Pro monte Fisio, pro civitate Iguvina, facito severe,
6. Kutef pesnimu; arepes arves.	6. Caute precator, adipes advehens.

The inscription is thus rendered into English by Donaldson: "Before the gate by which the treblæ enter, sacrifice three oxen to Jupiter Grabovius, offer up the hard fat, sacrifice with unsalted meal, either with wine or bread, for the Fisian mount, for the city of Iguvium, sacrifice reverently, pray cautiously, holding forth the soft fat (of the victims)."

In this inscription it is easy to recognise the original of many Latin words. It may simplify the proof of this fact if we exhibit the Umbrian words with their corresponding Latin representatives in a tabular form, while we refer to Donaldson's elaborate criticism for a more complete analysis of their forms:

Umbrian.	*Latin.*	
pre.	præ.	
veres, abl. plural of *verus.*	foribus.	
treplanes.	trebla.	Noticed by Cato (R. R. c. 135) as a rustic carriage. The gates are designated, as in other cases, with reference to the species of carriage admitted at them.
Krapuvius.	Gra-bovius.	May be compared with Gradivus, but the etymology is uncertain.
tre.	tres *or* tribus	Etymologists are uncertain whether to refer these words to the accusative or ablative case. Both constructions would be admissible.
buf.	boves *or* bobus.	
feitu (*or* fetu).	facito.	Compare *ditu* for dicito.
arvia.	arvina.	
ustentu.	obstineto.	The old Latin for *ostendito.*
vatuva ferina.	fatuâ farinâ.	
heris vinu heris puni.	vel vino vel pane.	*Heris* derived from Sanscrit root *hir*, a hand=particle of *choice.* So *vel*, from root of *volo.*
ocriper Fisiu.	pro monte Fisio.	*Ocris* occurs in Greek ὄκρις. Hence the names of some Umbrian towns *Ocriculum* and *Interocrea.* *Fisius*= Fidius Sancus, the old Italian name of Jupiter.
tota per Ikuvina.	pro civitate Iguvinâ.	*Tota* (tuta) connected with the adj. *totus*, the idea of a *city* being that of *completeness.* So the Greek πόλις connected with πόλυς.
sevum. kutif.	severè. cautè.	
adipes arves.	adipes advehens.	In both these words the prep. ar.=*ad* appears, as it commonly does in familiar Latin. The termination *eir* or *es* appears to be that of the Umbrian participle.

The remaining materials of the Umbrian language are tolerably copious, and have enabled philologers to form a fair conjecture of the declensions and conjugations of the nouns and verbs. The specimen already given is sufficient to show us the main points of resemblance between the Umbrian and the familiar Latin; though it must be confessed that the difficulties still besetting an explanation of the Umbrian philology must lead us to be cautious in applying these investigations to the support of

any theory as to the extent of Umbrian influence in the formation of the Latin tongue.

II. The Sabello-Oscan Language.

The language of the ancient Oscans and Sabellians, consisting, in all probability, of a fusion of the Umbrian Sabines with the Oscan population whom they conquered, is preserved in several remarkable remains. The most important of these is the *Bantine Table*. This document, which seems to have reference to the Apulian city of Bantia, mentioned in the inscription, was discovered in the year 1793 at Oppido, on the borders of Lucania. It consists of thirty lines, more or less incomplete, and is in consequence only partially deciphered. The next fragment of importance is a stone tablet known by the name of the *Cippus Abellanus*. This inscription seems to have referred to an agreement between the neighbouring Campanian cities Abella and Noa!. Its adventures are curious. In 1685 it was removed from *Avella Vecchia* to the modern village of that name, where it remained in use as a door-step until 1745, when it was remarked by Remondini, a professor in the Episcopal Seminary at Nola, and by him conveyed to the Museum in that seminary about 1750. The bronze Tablet of *Agnone*, the most recent contribution to our kgowledge of the Oscan language, was discovered at Fonte di Romito, between Capracotta and Agnoneni, 1848. It is, however, merely a series of dedications to different deities and heroes, and therefore does not add much to our vocabulary of the Sabello-Oscan language. We may add to these sources the fragments of the *Atellanæ*, the only remaining branch of Oscan literature. These tabulæ Atellanæ, we are told by Livy, were a species of farce, which were acted by the Roman youth in what we should call private theatricals; and their representation had the peculiarity of being permitted to citizens without any detriment to their civic rights.

As an example of this language, we will take a few lines from the Bantine Table:—

L. 11. . . . . . "Sudæ pis contrud eseik fafakust, auti komono hipust, molto etan—
" 12. to estud n. MM.; in suæ pis ionk fortis meddis moltaum herest ampert minstreis aeteis
" 13. eituas moltas moltaum likitud."

This is translated by Donaldson as follows:—"Si quis adversus hæc fecerit, ant com-unum (*i.e.*, agrum publicum) habuerit, (*i.e.*, possederit) multa tanta esto numi M.M., inde si quis eum validus magistratus multare voluerit, usque ad minores partes pecuniæ multas multare liceto."

In this passage we observe many words which throw some light upon etymological principles. Thus in L. 11. *eseik* points out the old neuter accusative plural of *is;* an important discovery in itself, as it enables us to account for such forms as *præter-eâ propter-eâ, inter-eâ*, and to identify the termination with that which appears in the words *posthâc, antehâc*. Again, *ionk*, in l., 12, exhibits the original form of the accusative case, corresponding to the ordinary Latin *hunc*. *Meddix*, again, represents a compound similar to *jud-ex*, and *vind-ex*, and seems to mean here *medium* dicens, or, according to another explanation, contains the root *med*+a merely formative ending x (= c–s). *Herest* is the perfect subjunctive of a verb *hero*="to choose" or "to take," (Sanscr. *hri*) from the root *hir*, "a hand," which we have already found, with a slightly different application, in the Umbrian Tables. *Am-pert* Donaldson considers to be equivalent to the Latin *usque ad*, from a comparison of *am* with the German *um*, also used in composition with other prepositions; while *pert* appears with several words in the sense of *ad*. *Minstreis* is used here in the sense of "less." The word *minis-ter* is, in fact, the correlative of *magis-ter*, the latter meaning a superior, the former an inferior functionary, contrasted as would be the consuls and prætors, and other higher Roman magistrates, with the subordinate attendants, such as were lictors and viators.

III. The Etruscan Language.

We now approach the great *crux philologorum*, the obscure problem of the origin and language of the Etruscans. In the former part of this Lecture, I have endeavoured to confirm the opinion of Niebuhr—that the pure Etruscans are to be considered as Northern Gothic invaders; as opposed to that theory (maintained by Dennis, and supported by Prof. Newman) which refers them to Lydia, and would class them among the Semitic family of nations. This question is so difficult, and a discussion of its merits so desirable, that I will here advance some further reasons of a positive character in confirmation of the negative reasoning by which I have above endeavoured to support the Gothic hypothesis.

1. It is acknowledged, I believe, by most philologers, that the Tyrrhenians and the Etruscans are two widely distinct people. The former name refers us at once to a Pelasgian race; the latter stands for a Northern tribe, who ultimately conquered this Pelasgian colony. Those who deny this distinction "have endeavoured, by a Procrustean method of etymology, to overcome the difficulties caused by the discrepancies of name."—(*Varronianus*, p. 16.) Those who can identify the names *Rasena* and *Tyrrheni* cannot expect to find any difficulties in ethnological or philological inquiries.

2. The express statement of Livy (v. 33), and that not in a hypothetical form, but in a chapter containing "one of the most definite expressions of ethnological facts to be met with in ancient history," goes to connect the Etruscans with the Rhæti, an Alpine tribe of Goths; an opinion confirmed also by Pliny and Justin, and by Stephanus of Byzantium. (See *Varronianus*, p. 18.)

3. The circumstances of the Etrurian invasion bear a striking resemblance to the later invasion of the Gauls; so much so, that it is hard to refer the different invaders to any but one and the same geographical source. The immigration of the various Germanic tribes into the West, accompanied in their gradual advance by a lateral expansion of portions of their force, drove the Rhæti in the first instance to invade the rich territory of the dominant Tyrrheno-Pelasgians, who had extended their rule over the old Umbrian population to the north and east of the Tiber. The same cause pushed the Gauls down from the old haunts of the Rhæti into the rich settlements of their precursors. Successfully establishing themselves in the vast plains of the Po, the territory afterwards named Cisalpine Gaul, they swept over Umbria and Etruria, and even sacked Rome. But again they were borne back to the old starting point of the Etrurians, and Italy was saved a second time by the city of Horatius and Camillus.

4. We find that there was a marked difference between the town language in Southern Etruria and that of the country, which can be accounted for only on the supposition that the conquerors established themselves in cities, leaving the cultivation of the fields to the old inhabitants, who occupied the position of the Saxons in England, and the periœci in Laconia.

In accordance with the historical facts of the successive occupations of the Etrurian territory, we find two main ingredients of the Etruscan language derived on the one hand from the original inhabitants and their Pelasgian conquerors, on the other from the Gothic tribe of Rasena, who conquered the Pelasgians in their turn. The Etruscan language, then, is partly a Pelasgian idiom, more or less corrupted and deformed by contact with the Umbrians, and in part a relic of the oldest Low-German or Scandinavian dialects. (*Varronianus*, chap. V.)

We may select for inspection a specimen belonging to each of these classes, as given by Donaldson. It is remarkable that the following inscription was discovered at Cervetri, the ancient Cære, the old stronghold of the Agyllæans, a race of marked Pelasgic character; and we should therefore expect a different style from that which marks the remains of Northern and Eastern Etruria, where the Umbro-Etruscan and Rasenic languages would prevail. Accordingly, in the following lines we immediately recognize not only Greek forms, but also the heroic metre which arose in Greece, and was afterwards fully naturalized in Italy by the poetic genius of Lucretius and Virgil, while there is, at the same time, a slight admixture of the Tuscan vocabulary.

> "Mi ni kethuma, mi methu maram lisiai thipurenai;
> Ethe erai sie epana, mi nethu nastav helephu."

The meaning of this couplet is thus given by Donaldson: "I am not dust; I am ruddy wine on burnt ashes: When there is burn'ng heat under ground, I am water for thirsty lips:"—a poetical description of the various uses of a drinking vase.

In the words *mi kethuma*, *methu*, *maram*, *erai*, we recognize the Greek εἰμί, χθαμαλὸς, and χθαμαί, Latin *humus;* μέθυ, μάρων (the grandson of Bacchus): compare 'Ισμαρος, and μαίρω: and ἔρα, the ancient root of a word meaning the earth. *Lisiai* and *thipurenai* seem to be connected, the former with *lix*, "ashes mixed with water," the latter with the root of *tepidus*, &c. *Epana*, *nastav*, *and helephu* are of doubtful etymology. *Nethu* seems very probably to be a Tuscan word for water. We find Neptune written *Nethuns*. The explanation of the words *nastav* and *helephu* is conjectural.

We pass on now to the other branch of Etruscan inscriptions; those which present the Rasenic type of the language, and claim affinity with the Scandinavian, old Norse, and Runic languages; suggesting a link between the famous king whose prowess spread terror to the gates of Rome, and the no less dreaded warriors who scoured the Baltic and German Seas, and startled with their piratical cry the sleeping peasant on the coast of Kent.

The Runic affinities of the Rasenic language are most fully exemplified by the great Perugian Inscription, which is critically examined by Donaldson. (*Varronianus*, V., § 10.) My space forbids me to do more than to refer to the elaborate researches of Donaldson on this point. One or two examples may be given of the resemblance between the ancient Etruscan and the northern dialects. Thus the word *clan* or *clen*, which occurs frequently in Etruscan in the signification of *child*, is illustrated by the Icelandic *klen* or *klien*, a synonyme of the German *klein*, but primarily in the instance of a child as opposed to a man. Icelandic explanations, too, are given of the words *phleres*, signifying a votive-offering; *ceca*=to build or to cause to be made—in Icelandic, *kasa*. These words appear in the following inscription upon a bronze figure representing Apollo crowned with laurel; where we meet with a singular union of Pelasgian and Scandinavian forms:

> Mi phleres epul aphe aritimi
> Phasti ruphura turce clen ceca.

which is translated, "I am a votive-offering to Apollo and Artemis: Fastia Rufria, the daughter of Tuscus, had me made."

Thus philological as well as ethnological considerations confirm the conclusions at which we arrived above; which may here be very briefly recapitulated. The Etruscans, in the largest sense of that term, may, without contradiction, claim both Pelasgian and Rhætian affinities. The former may be represented by the Herodotean story of a Lydian colonization; the latter is confirmed by the express testimony of Livy and other ethnological authors.*

IV. The Old Roman Language.

The last division of our inquiry refers to the oldest remaining form of the Roman language, represented in its pure character as a rude compound of the Umbrian, Oscan, and Etruscan. Greek civilization had so changed the tone of the people and their language, that Polybius, speaking of the old treaty between Rome and Carthage (III., 22) tells us that in his time even the educated Romans could with difficulty interpret the existing memorials of the oldest form of their own language. Many interesting specimens of this ancient tongue have been preserved. Thus we are familiar with the existing remains of the XII Tables; with the Arvalian Litany; the Inscription on the Columna Rostrata; the Senatus Consultum de Bacchanalibus; and above all, with the Epitaphs of the Scipios. Besides these, we have the old Roman Law on the Bantine Table; certain fragments of laws, preserved by Festus; and copies from the Tiburtine Inscription, itself now unfortunately lost. The most interesting specimen which my space allows me to quote is the Epitaph on the flamen dialis P. Scipio, son of the elder Africanus, and adoptive father of the younger, whose praises are fully borne out by the soberer statement of Cicero. In the following arrangement we preserve the old Saturnian rythm, the peculiar metre of early Roman poetry:

> Quei apice' insigne dialis | flaminis geslstei,
> Mors perfecit tua ut essent | omnia brevia,
> Honos fama virtusque | gloria atque ingenium.
> Quibns sei in longa licuisset | tibi utier vita,
> Facile facteis superasses | gloriam majorum.
> Qua re lubens te greiniu, | Scipio recipit terra,
> Publi, prognatum | Publio, Corneli.†

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* One objection must be here noticed—which was made by Professor Wilson on the occasion of this Paper being read at the Canadian Institute, viz., that the writing of the Etruscans points to a Semitic origin; in Etruscan as well as in Phœnician and other Semitic writing, the course of the lines being from right to left. This argument is valid with reference to Etruria exactly so far as it is valid for Greece. It is well known that ancient Greek was at first written from right to left; then indifferently either way; then alternately (a method which was termed "Boustrophedon," from its resemblance to the course of oxen in ploughing, first in one direction, then in the other); and lastly from left to right. Supposing its importation into Etruria at a period when it was written in the earliest manner, it will not appear strange that the colonists should have clung to the old fashion long after it had been altered in the mother country. A curious specimen of an inscription in Boustrophedon is given by Leake. ("Asia Minor," p. 239, 240, note.)

† The following is a literal, and, I fear, bald translation; but it may serve to give the reader an idea of the metre and meaning of the original:

> Thè sácred priéstly sýmbol | décked thy nóble fórehead;
> Yèt Déath lays lów thy hónor | fáme and vírtuous áctions,
> Búrying shórt-lived glóry and | súbtle mínd togéther.
> Hàd ít been thíne to finish | à góod old áge and áctive,
> Líghtly thou hádst outstripped | thy óld ancéstral glóries.

I have thus, as far as the present state of philological knowledge permits, endeavoured to represent the original languages of Italy, and to draw from the consideration of their remains, conclusions which seem to explain the ethnographical history of the races anciently inhabiting the peninsula. In advancing his speculations, a student must necessariiy labour under a feeling of diffidence, the natural result of the difficulty and comparative uncertainty of such inquiries. Thus, whether we see reason to agree with, or to differ from, other scholars, we feel convinced that all parties are as yet only on the threshold of philological and ethnological truth, and that the door will not be opened but to the patient and modest inquirer. The secret storehouse of the great harvest of philology, and therefore of ancient history, is yet to find; we must content ourselves if we are allowed to glean a few scattered ears on the deserted field. Our aim must be to notice the position of these remains, the direction which the track of the harvesters seems to have taken; that with sure though unequal steps we may follow them from field to field, till we reach the great depositary itself, and are able surely to ascertain the relations of the great tribes of the old world with one another and with ourselves.

And nów the Eárth recéives thee | with lóving ópen bósom,
Scípio, greát Cornélius, | míghty són of Públius.

This ancient metre is well described by Macaulay (Preface to "Lays of Ancient Rome,") and by Donaldson ("Varronianus," ch. VI.). It seems to have existed in Italy from the earliest times, as it may be traced in the Eugubine Tables. Perhaps our children, when they sing the fame of the "Four and twenty blackbirds baked in a pie," are not aware that in some old Umbrian village, which,

"Like an eagle's nest, hung on the crest
Of purple Appennine,"

some good three thousand years ago, they hushed their children to sleep to the same tune.

A Lake Phenomenon.

The "Niagara Mail," of May 3d, describes at some length a remarkable phenomenon which occurred on the 25th of April at the head of Lake Ontario, near the mouth of the Niagara river. Below is the "Mail's" description of this singular occurrence:

"In alluding in our last to the remarkable case of two persons being drowned (one of whom was James Foster, an old sailor, and not a pensioner, as we heard), we had not time to do more than chronicle the bare fact, without enlarging on the singular phenomenon which caused their death.—Since then, however, we have made minute inquiries into the circumstances, and remain satisfied that the sudden and extraordinary overflow of the Lake, which occurred on the 25th ult., originated in some subaqueous convulsion, which took place in the bed of the Lake.

The facts of the event of the 25th, as far as noticed, seem to be as follows:—About a quarter or half-past six o'clock, P.M., a thunder storm came up from the north-west, with a few flashes of lightning, and a heavy shower, accompanied by a strong squall of wind for a few minutes, the weather being quite calm just before the gust, and the same after it. The fishermen who were on the beach, seeing the squall come on, hurried to get in their seine, when suddenly there appeared, rolling in upon them, an immense wave from the north-west. The height of this wave could not have been less, we judge, than from six to eight feet, although it is difficult to ascertain correctly. It came rolling on the smooth lake with great velocity, carrying all before it, and sweeping some of the fishermen into the Two-mile Pond, and dashing others of them high up against the bank, by which, as we related, two persons were unfortunately drowned. The water came and returned three times in succession, and then settled down quite calm, as it had been before this commotion. It was noticed, moreover, that the wave brought up and cast upon the beach a quantity of logs and sunken drift wood, which had apparently lain long at the bottom of the lake, showing clearly that the movement must have come from the bottom. There was no wind blowing to cause such an unprecedented and rapid swell of the water, the like of which had never been seen on this side of the lake, although something similar occurred at Cobourg some couple of years ago, and a similar phenomenon is related as having taken place in Mud Lake within a few years.

It is evident to us that there has been an earthquake in the bed of the Lake, at no great distance from land, although there was not the slightest tremour noticed on shore. These occurrences, taking place as they do, would seem to indicate that the bed of the Lake is nearer the seat of subterranean disturbance than the main land, and may undergo agitation at times, without the fact being noticed by dwellers on its margin; but when the earthquake was felt here about eighteen months ago, the rush of waves upon the shore for a short time was tremendous. But the disturbance in that case being, in all probability, further off, prevented a great and sudden rise of water like that on the 25th.

It has been shown, in support of a certain theory, that by far the greatest number of earthquakes have occurred about the new or full of the moon. This theory may receive another case in its support, by the consideration that the event above recorded took place within thirty-one hours of the new moon. We leave the matter as one worthy of philosophical consideration."

The subject of lake convulsions is one of acknowledged difficulty, and in the present state of our knowledge of those phenomena, we need not hesitate to record all events which may have some connection with such mysterious visitations, or in submitting to the consideration and discussion of scientific men theories which appear to involve the true explanation of their origin and recurrence.

As having a possible bearing upon the late lamentable event, we may record the occurrence of a whirlwind which was observed in the neighbourhood of Toronto, at a few minutes after one o'clock P.M., on the same day—the 25th April.

Attention was first drawn to the whirlwind by the falling of a vast number of dead leaves, on Dundas Street, about half a mile north-west of the Lunatic Asylum. A narrow belt of air, apparently not exceeding two hundred and fifty yards in width, was first observed to be filled, as it were, with innumerable dead leaves, tumultuously tossed about, chiefly in an upward direction, and at a considerable elevation. Above this moving stratum of leaves several yellowish coloured detached clouds, apparently of fine particles of sand and dust, were whirled on in the same direction as the leaves, which was from the north-west to the south-east. The leaves and clouds of dust had been noticed for three or four minutes before any signs of wind at the surface appeared. The first indication of the approaching vertical shaft of air was seen in the topmost branches of a number of large pine trees west of the Hon. S. B. Harrison's house, near Dundas Street. The motion produced in the uppermost branches was very violent, but it did not appear materially to affect the lower branches or smaller trees. The tops of small pines and cedars, two or three hundred yards east of the tall pines before noticed, were much twisted, but still comparatively little effect was observed at the surface until the chief force of the whirlwind had passed over the spot where these observations were made. The effect of the whirlwind was not distinguishable for a greater breadth at the surface than between two and three hundred yards; at a considerable elevation, however, after the passage of the vortical shaft at the surface, the air above seemed filled for a much greater breadth, and to a great altitude, with detached cloud masses of dust and leaves. The idea conveyed by the whole phenomenon was that of an enormous revolving inverted cone of air moving in an inclined direction with great rapidity and violence from north-west to south-east, the apex of the inverted cone being of small diameter (about 200 yards), the base of far more imposing dimensions.

This phenomenon, although frequent even in Canada during the summer months, acquires interest when considered in connection with the occurrence recorded by the editor of the "Niagara Mail," and if followed at a later hour of the day by another whirlwind of greater dimensions, might also afford an explanation of the remarkable and disastrous event which caused the death of two persons near the mouth of the Niagara river. We have not as yet heard of any other occurrence of a whirlwind or notable local variation in atmospheric pressure on the same day, and as the difference in point of time between the lake convulsion and the phenomenon just noticed, exceeds five hours, it seems scarcely probable that a *Seiche*, produced by sudden variation in atmospheric pressure, could have connected the events. (See Canadian Journal. Vol. II, p. 29, for an interesting paper on the Seiches of Lakes, by Colonel Jackson). We are indebted to the Director of the Provincial Magnetic Observatory for the following abstract from the Meteorological Journal of that establishment:—

APRIL 25TH, 1854.

Hour of observation.	Observed barometer.	Barometer reduced to 32°F.	Difference of Barometer from normal reading.	Pressure of dry air.	Humidity.	Temperature.	Difference of Temperature from normal	Direction of Wind.	Velocity of wind in miles per hour.	Direction of motion of clouds from	Cloudiness.	Remarks.
6 A.M.	29.584	29·509	—0·150	29·260	83	45·4	+6·7	SSW	2·4	None.	0·0	Hazy round horizon.
8 "	·574	·501	—0·177	·175	79	54·2	+10·6	ESE	2·9	W	0.4	Cirro-cum. generally dispersed.
2 P.M.	·514	·484	—0·205	·168	43	65·1	+18·9	SE by E	5·2	W	1·0	Overcast and hazy.
4 "	·470	·390	—0·286	·103	51	63·2	+12·8	SE by E	7·8	W	1·0	Do., heavy thunder-storm, with rain, from 5·50 to 6.45.
10 "	·436	·353	—0·287	·046	91	48·5	+7·0	NE by E	3·2	NW	1·0	Densely overcast.
Midnight	·452	·398	—0·263	·053	94	48·5	+8·0	NE by E	4·1	Not per.	1·0	Do., very dark, spitting rain occasionally.

Two interesting circumstances appear upon an examination of the above table—the first being the sudden diminution in the degree of humidity of the atmosphere; at 6 A.M., the humidity was represented by 83, the point of saturation being 100; at 2 P.M.—after the passage of the whirlwind—the humidity was reduced to 43; at 10 P.M.—after the thunder-storm—it rose, as might have been anticipated, to 91. At 2 P.M. the wind was from S.E. by E.; at 10 P.M. from N.E. by E., the direction of the motion of the clouds being, at 2 P.M., *west*, and at 10 P.M., *north-west.*

Two nearly opposite currents of air are thus recorded as having been observed about the time of the whirlwind, and when these facts are associated with the very gradual fall of the barometer, we arrive at the conclusion that the whirlwind was the result of the meeting of the opposing currents of air—probably of different temperatures and different degrees of humidity—and did not exercise an appreciable influence a mile on either side of its track—the distance of the observatory from the line of its passage rather exceeding a mile.

By reference to the quotation from the "Niagara Mail," it will be seen that the editor of that paper considers the cause of the Lake convulsion to have been an earthquake, which is inferred "to indicate that the bed of the Lake is nearer the seat of subterranean disturbance than the mainland, and may undergo agitation at times without the fact being noticed by the dwellers upon its margin." In addition to this hypothesis, we may call attention to two geological features of this part of North America, which are not devoid of interest, and to say the least, afford material for speculation as to the connection with recent events of forces which operated with wonderful energy in times very remote from us now.

On page 27 of the Geological Report of Canada for 1845, the distinguished director of the Survey, in speaking of the origin of the Apalachian chain of mountains and the quiescent condition of the Illinois and Michigan coal fields, as compared with the disturbed condition of some portions of the Pennsylvanian deposits, remarks—"It does not seem improbable, however, that the broad low anticlinal arch which separates these two from the other (the Michigan and Illinois from the Pennsylvanian), may have some relation to the expiring effort of those forces; for, although its axis cannot be called precisely parallel to the Apalachian undulations, there are yet bends in it that seem to correspond with some of the curves of that chain of mountains. From Monroe County, in Kentucky, this axis takes a gently sinuous course, running under Cincinnati on the Ohio, to the upper end of Lake Erie; thence it curves to the upper end of Lake Ontario, where my assistant, Mr. Murray, has observed its influence in deflecting the strike of the strata in the neighbourhood of Burlington Bay. It then enters the Lake, under the waters of which it *probably* dies away towards the north shore."

The depth of Lake Ontario, between Toronto and the mouth of the Niagara river, exceeds 400 feet, and, in some parts of that line, is stated by mariners to be much greater. The bed of the lake, west of the Niagara river, is excavated in the Medina sandstone, which is known to be far thicker at the western extremity of the Lake than in its south-eastern development. Its thickness in the Niagara District is upwards of 600 feet, and borings have been made in this rock at St. Catherines to a depth of 480 feet below the level of Lake Ontario. It thins out and disappears in Oneida County, in the State of New York. The formations below the Medina sandstone, known by the names of Oneida Conglomerate and Grey sandstone, do not appear on the north

side of the Lake. It is probable, in the supposed absence of the undulation described by Mr. Logan, that the Hudson River group would form the floor of the Lake a few miles north of a line drawn between Oswego and the Credit. This would be succeeded by a narrow band of the Utica slate, and then by the Trenton limestone and its associated rocks, reposing upon the metamorphic series displayed at the east end of the Lake. The existence, however, of the undulation before alluded to would have the effect of changing, in some measure, the subaqueous outcrop of these rocks. We may, perhaps, connect the phenomenon which has recently occurred at Niagara, with others of the same class recorded as having been witnessed at Port Hope, Cobourg, and Rice Lake, if we suppose that the anticlinal axis spoken of by Mr. Logan—persisting in those sinuosities which had already distinguished its progress—trended to the south shore, and died away in the direction of the middle of the Lake. The effect of this undulation would be to bring the Utica slate within the excavating influence of the waters of the Lake south of Niagara. An inspection of a chart of Lake Ontario shows how unequally this excavating process has gone on. Between Toronto and the Niagara river we find on Lieut. Herbert's chart the following depths:—At about five miles south of Toronto, 180 feet; 14 miles, 402 feet; 22 miles, 210 feet. In other parts of the Lake still greater unevenness in its floor occurs, which is scarcely to be explained by tertiary formations. Now, when we consider that the phenomenon at Grafton was accompanied by the "water boiling, as you see in the lesser rapids of the St. Lawrence," (See Canadian Journal, Vol. II., page 63.) the hypothesis becomes well grounded that these Lake convulsions arise from the sudden liberation of vast masses of carburetted hydrogen and other gases which result from the decomposition of immense accumulations of vegetab'e and animal remains, which distinguish the black bituminous shales of the Utica slate. The Niagara river daily exhibits the vast supply of carburetted hydrogen which the Niagara Limestone and other rocks over which it flows near the Falls, is capable of producing, and the Utica slate is especially distinguished by the presence of this gas in vast abundance.

The phenomena at Port Hope, Rice Lake, Grafton, and Niagara, become at once connected, if it be true that the Utica slate forms a portion of the bed of the Lake a few miles north of the mouth of the Niagara river, and that the suddenly liberated gases from that rock are capable of producing the effects observed. It is clear that, under such circumstances, the earthquake which occurred on March 13th, 1853, which was felt at Toronto, Niagara, &c., would assist the escape of the pent-up gases, and might, therefore, play a secondary part in occasioning the rush of waves on the shores noticed at Niagara, but not be the actual cause of the phenemenon.

The boiling appearance of the Lake produced off Grafton, in 1847, is precisely what would be observed as the effect of the escape of gas from the floor of the Lake; and it is well known that deep wells and shafts sunk in the Utica slate in its exposures in the township of Whitby are rapidly filled, when left in a state of repose, with light carburetted hydrogen mixed with sulphuretted hydrogen. The same phenomena are observable in deep wells sunk in the Hudson river group at Toronto, and during the last summer a constant bubbling up of carburetted hydrogen occurred during many weeks in a well on Queen Street. The Utica slate, however, from its remarkable bituminous character, is particularly distinguished by the emission of gases when its strata are penetrated, and thus affords reasonable ground for the hypothesis that many violent Lake convulsions are caused by the sudden liberation of pent-up gases, resulting from the decomposition of the carbonaceous accumulations which characterize it.

Miscellaneous Intelligence.

Identity of Dynamic or Voltaic Electricity with Static or Frictional Electricity.—By Professor Faraday.*

The Friday evening meetings for the season commenced at the Royal Institution on Friday last, the opening lecture being delivered by Professor Faraday to a very crowded audience. The subject was the developement of electrical principles produced by the working of the electric telegraph. To illustrate the subject, there was an extensive apparatus of voltaic batteries, consisting of 450 pairs of plates, supplied by the Electric Telegraph Company, and eight miles of wire, covered with gutta percha, four miles of which in coils were immersed in tubs of water, to show the effect of submersion on the conducting properties of the wire in submarine operations. The principal point which Professor Faraday was anxious to illustrate, was the confirmation which experiments on the large scale of the electric telegraph have afforded of the identity of dynamic or voltaic electricity with static or frictional electricity. In the first place, however, he exemplified the distinction between conductors and non-conductors, impressing strongly on the audience that no known substance is either a perfect conductor of electricity or a perfect non-conductor, the most perfect known insulator transmitting some portion of the electric fluid, whilst metals, the best conductors, offer considerable resistance to its transmission. Thus the copper wires of the submarine electric telegraph, though covered with a thickness of gutta percha double the diameter of the wire, permit an appreciable quantity of the electricity transmitted to escape through the water; but the insulation is nevertheless, so good that the wire retains a charge for more than half an hour after connexion with the voltaic battery has been broken. Professor Faraday stated that he had witnessed this effect at the Gutta Percha Works, where one hundred miles of wire were immersed in the canal. After communication with a volatic battery of great intensity, the wire became charged with electricity, in the same manner as a Leyden jar, and he received a succession of forty small shocks from the wire, after it had been charged and the connexion with the battery broken. No such effect takes place when the coils of wire are suspended in the air, because in the latter case there is no external conducting substance. The storing-up of the electricity in the wire when immersed in water is exactly similar to the retention of electricity in a Leyden jar, and the phenomena exhibited correspond exactly with those of static electricity, proving in this manner, as had previously been proved by charging a Leyden jar with a volatic battery, that a dynamic and static electricity are only different conditions of the same force; one being great in quantity, but of low intensity, whilst the latter is small in quantity, but of great intensity. Some interesting facts connected with the conduction of electricity have also been disclosed by the working of the submarine telegraph, which Professor Faraday said confirmed the opinion he had expressed twenty years ago, that the conducting power of bodies varies under different circumstances. In the original experiments by Professor Wheatstone, to ascertain the rapidity with which electricity is transmitted along copper wire, it was found that an electric spark passed through a space of 280,000 miles in a second. Subsequent experiments with telegraph wires have given different results, not arising from inacuracy in the experiments, but from different conditions of the conducting wires. It has been determined that the velocity of the transmission through iron wire is 16,000 miles a second, whilst it does not exceed 2700 miles in the same space of time in the telegraph wire between London and Brussels, a great portion of which is submerged in the German Ocean. The retardation of the force in its passage through insulated wire immersed in water is calculated to have an important practical bearing in effecting a telegraph communication with America; for it was stated that, in a length of 2000 miles, three or more waves of electric force might be transmitting at the same time, and that if the current be reversed, a signal sent through the wire might be recalled before it arrived at America. Professor Faraday concluded by exhibiting a beautiful experiment illustrative of the identity of voltaic and frictional electricity. The terminal wires of a powerful secondary-coil apparatus were placed seven inches apart within the receiver of an air pump, and when the receiver was exhausted, a stream of purple colored light passed between the wires, resembling, though more continuous and brilliant, the imitation of the aurora borealis produced when an electric spark is passed through an exhausted glass tube. The volatic power employed to produce this effect of static electricity was only three cells of Grove's battery.

* From the London Mechanics' Magazine, January 7.

Deposition of Aluminium and Silicium by the Electrotype Process.

Mr. Gore, of Birmingham, has succeeded in depositing aluminium and silicium upon copper, by the electrotype process. To obtain the former, he boils an excess of dry hydrous alumina in hydrochloric acid for one hour, then, pouring off the clear liquid, adds one-sixth its volume of water. In this mixture was set an earthern porous vessel, containing sulphuric acid, diluted with 12 parts of water, with a piece of amalgamated zinc plate in it. In the chloride of aluminium solution was immersed a plate of copper, of the same amount of immersed metallic surface as that of the zinc, and connected with the zinc by a copper wire. The whole was then set aside for some hours, and, when examined, the copper was found coated with a lead-coloured deposit of aluminium, which, when burnished, possessd the same degree of whiteness as platinum, and did not readily tarnish, either by immersion in cold water, or by the action of the atmosphere, but was acted on by sulphuric and nitric acid, whether concentrated or dillute. If the apparatus is kept quite warm, and a copper plate much smaller than the zinc plate is employed, the deposit appears in a very short time—sometimes in half-a-minute; if the chloride solution is not diluted with water, the deposit is equally, if not more rapid.

The author has also succeeded in obtaining a quick desposit of aluminium, in a less pure state, by dissolving common pipe-clay in boiling hydrochloric acid, and using the clear liquid undiluted in place of the above-mentioned chloride. Similar deposits were obtained from a strong aqueous solution of acetate of alumina, and from common alum, but more slowly. With each of the solutions named, the deposit was hastened by putting from one to three small Smee's batteries in the circuit.

To obtain the deposit of silicium, monosilicate of potash (prepared by melting together 1 part silica with 2½ parts carbonate of potash), was dissolved in water, in the proportion of 40 grains to one ounce measure, proceeding as with aluminium, the process being hastened by interposing a Smee's battery in the circuit. With a very slow and feeble action of the battery, the colour of the deposited metal closely resembled that of silver.—*Artizan*.

On Soap as a Means of Art. *

By Ferguson Branson, M.D., Sheffield.

Several years ago, I was endeavoring to find an easy substitute for wood engraving, or rather to find out a substance more readily cut than wood, and yet sufficiently firm to allow of a cast being taken from the surface when the design was finished, to be re-produced in type metal, or by the electrotype process. After trying various substances, I at last hit upon one which at first promised success, viz., the very common substance called soap, but I found that much more skill than I possessed was required to cut the fine lines for surface printing. A very little experience with the material convinced me that, though it might not supply the place of wood for surface printing, it contained within itself the capability of being extensively applied to various useful and artistic processes in a manner hitherto unknown. Die-sinking is a tedious process, and no method of die-sinking that I am aware of admits of freedom of handling. A drawing may be executed with a hard point on a smooth piece of soap almost as readily, as freely, and in as short a time as an ordinary drawing with a lead pencil. Every touch thus produced is clear, sharp, and well defined. When the drawing is finished a cast may be taken from the surface in plaster, or, better still, by pressing the soap firmly into heated gutta percha. In gutta percha several impressions may be taken without injuring the soap, so as to admit of "proofs" being taken and corrections made—a very valuable and practical quality in soap. It will even bear being pressed into melted sealing-wax without injury. I have never tried a sulphur mould, but I imagine an impression from the soap could easily be taken by that method. The accompanying specimens will show that from the gutta percha or plaster cast thus obtained a cast in brass, with the impression either sunk or in relief, can at once be taken. If sunk, a die is obtained capable of embossing paper or leather; if in relief, an artistic *drawing* in metal. This suggests a valuable application. The manufacturer may thus employ the most skilful artist to make the drawing on the soap, and a fac-simile of the actual touches of the artist can be reproduced in metal, paper, leather, gutta percha, or any other material capable of receiving an impression. By this means even high art can be applied in various ways—not a translation of the artist's work by another hand, as in die-sinking, but the veritable production of the artist himself. One of the specimens sent is a copy of Sir E. Landseer's "Highland Piper," a rude one, I must confess, though its rudeness does not militate against the principal involved in its production. Suppose the drawing had been made by Sir E. Landseer himself; that accomplished artist's actual drawing might have been embossed on various materials in common use, and disseminated amongst thousands, thus familiarizing the eyes of the public with high art, and giving a value to the embossed transcript which no translation by the die-sinker, however skilful, could possibly give it. The raised gutta percha impression of this specimen is from soap itself; the sunk impression is cast in gutta percha from gutta percha. The works in metal during the 14th, 15th, and 16th centuries, owe their excellence in a great degree to the same individual of artist and artisan. The metal was finished by the artist himself, who left the stamp of his genius unmistakably upon it. By the plan just explained, something like a return to this combination might be effected, and the artist would at least have the satisfaction of finding his own work accurately rendered, and not enfeebled in the translation; for the art of casting in metal has of late been so much improved, that little difference can be detected between the impression on the cast and the mould which produced it. I wish to lay particular stress upon the fact that *drawing touches* can be thus rendered, and an effect *rapidly* produced, unattainable by modelling. The larger plaster casts were taken from drawings freely made—as the appearance of the touches will prove—in common brown soap. The finer kind of soap is of course better fitted for fine work; but should the process now described be adopted by the manufacturer—and I trust it may never become the subject of any patent—soap better suited to the purpose than any now made will doubtless be specially manufactured. In proof that fine lines can be drawn upon soap as well as broad vigorous touches, I can state that one of Rembrandt's etchings has been copied on soap, the soap pressed into gutta percha, and an electrotype taken from the gutta percha cast from which a print has been obtained very little inferior in delicacy to the original etching. Doubtless persons engaged in manufactures will see applications of the process which I have not contemplated, and I leave it to their ingenuity to discover them, and I would particularly call the attention of ornamental leather and paper manufacturers, book-binders, and, possibly, manufacturers of china, to the process, for it must be remembered that soap when made can be run into moulds of any form, so as to obtain curved as well as flat surfaces for the artist to draw upon. It has also occurred to me that it would prove a very ready and expeditious method of forming raised maps, pictures, and diagrams for the use of the blind. The manipulation is very simple. A lead pencil drawing if required, can readily be transferred to the smoothed surface of the soap, by placing the face of the drawing on the soap, and rubbing the back of the paper; every line of the drawing is then distinctly visible on the soap. The implements used are equally simple; all the specimens sent were drawn with ivory knitting-needles, and small ivory netting meshes for scooping out larger and deeper touches. The only caution necessary is to avoid under-cutting. Having felt the greatest interest in the establishment of schools of design, so well calculated to reconnect Fine Art with manufactures, it will afford me sincere gratification if the simple process now pointed out—and I trust its simplicity will be no bar to its being carefully tested—shall be in the smallest degree instrumental in accomplishing the re-union.

P.S.—The date 1850 is on some of the illustrative specimens.

* Dr. Branson has also employed Bees' wax, white wax, sealing wax, lacs, as well as other plastic bodies; and in some of these cases a heated steel knitting needle or point was substituted for the ivory knitting needle.—Ed. *Jour. Soc. of Arts.*

Rate of Transmission of Impressions made upon the Nerves, by M. Helmholtz of Konigsberg.—The results of the author's experiments upon the human subject were as follows:—The intelligence of an impression made upon the ends of the nerves in communication with the skin is transmitted to the brain with a velocity which does not vary in different individuals, nor at different times, of about 60 metres, or 195 feet per second. Arrived at the brain an interval of about 1-10th of a second passes before the will, even when the attention is strung to the uttermost, is able to give the command to the nerves that certain muscles shall execute a certain motion. This interval varies in different persons, and depends chiefly upon the degree of attention. It varies also at different times in the case of the same person. When the attention is lax, it is very irregular, but when fixed very regular. The command travels probably with the same velocity toward the muscle. Finally about the 1-100th of a second passes after the receipt of the command before the muscle is in full activity. In all therefore from the excitation of the sensitive nerves till the moving of the muscle 1¼ to two-tenths of a second are consumed.

New Planet.—Mr. Marth, assistant at Mr. Bishop's observatory, Regent's Park, London, discovered on the 2nd March last a new planet close to the bright star Spica in Virgo. It appears as a star of the 10th magnitude. The same object was discovered by Mr. Norman Pogson, one of the assistants of the Radcliffe observatory, Oxford, on the evening of the 3rd March.

Royal Society of Literature.

At the last meeting of this society, Mr. Vaux read a paper, communicated to him by Captain Ormsby, of the Indian navy, "On the name given by Pharaoh to the Patriarch Joseph." The object of Captain Ormsby's paper was to show that the translation in the margin of our Bibles of the name "Zaphnath Paaneah" (the title conferred upon Joseph,) viz., "Revealer of secrets," was not confirmed by the analysis of the name itself; but that, on the other hand, a much more natural one was discoverable. Captain Ormsby remarked that there was nothing in the sacred narrative that would lead us to suppose that the patriarch either became himself a Pharoah, or was deified as Hermes, as some have supposed. It is quite clear that Pharoah did not lose sight of the fact that Joseph was a foreigner, and, as such, an abomination to the native population, while we know that after his death, though he was embalmed after the fashion of Egypt, he was not placed in any of the chambers of the Egyptian dead, but was eventually conveyed to the land from whence he came. His positon and rank were, however, secured to him by his investiture with the collar and raiment of fine linen, and by the reception of the royal signet ring, which was placed upon his finger; but still more so by his marriage with the daughter of the high priest of On the (Heliopolis of the Greeks, and one of the most sacred of the ancient cities of Egypt,) and by his subsequent naturalization, which was completed by a change of name—a custom then prevalent in Egypt, as it is still throughout the Oriental world. Captain Ormsby then proceeded to reduce the words "Zaphnath Paaneah" to their equivalents in hieroglyphical consonants, and showed, by a comparison of words in the "Book of the Dead," that they may be interpreted "The sustainer of life," or "The support of Pharaoh." The same result he proved to follow from an analysis of the title as spelt in the Septuagint.

Artificial Pearls.

The artificial production of pearls from the mussle fish is carried on to a great extent at Hoochow. The fish are collected in April or May, and are opened by children, who place a small bit of bamboo in the orifice to keep the shells apart. A piece of brass or bone, a small pebble, or a pellet of mud, is then introduced, a dose from 3 to 5 spoonfuls of fish-scales pounded and mixed with water is poured in, and the stick removed. The fish are then placed a few inches apart in ponds, the water in which is from 3 to 5 feet deep, and which are well manured with night soil four or five times every year. In these ponds the fish are allowed to remain from ten months to three years. Upon taking them out, the shell is cut through with a fine saw, the pearl is separated from the shell, and the pellet, or other substance within it, extricated. It is then filled with white wax, and a piece of the shell carefully attached to conceal the aperture. Several millions of pearls are thus produced annually, which find a market at Hoochow, and are worth from about a penny to eight pence a pair. Whole villages are engaged in their production, and some 5,000 people are said to gain a livelihood by the trade. The process was discovered in the 13th century by a native of Hoochow, named Ye-jin, to whose memory a temple was erected, in which festivities are still observed in his honour. The Canton process of making pearls does not succeed at Hoochow, nor does the Hoochow method prosper with the Canton people, who are in general so sucessful. There would seem, therefore, to be some peculiarity in the fish or climate of Hoochow, for, so far as can be learned, Hoochow is the only place in China where the process is carried on.

On the Ammonia contained in Rain-water.—M. Boussingault has continued at his country seat at Liebfrauenberg (Lower Rhine) his researches mentioned in the November number of this Journal. From his new investigations it appears that rain of the country contains less ammonia than that of the city, and that the ammonia is more abundant at the beginning than at the end of a shower.

Boussingault has examined also the dew, and, found it always to contain ammonia. The proportions, by several trials, were 6 milligrams to the litre; but the amount is reduced to 1·02 after a rainy day. On the 14th to the 16th of November a thick mist prevailed, so rich in ammonia, that the water had an alkaline reaction; a litre of the water contained about 2 decigrams of carbonate of ammonia. Seventy-five rains (including the dew and mist) examined by Boussingault between the 26th of May and the 8th of November, contained, as a mean, half a milligram of ammonia. The great quantity of ammonia contained in the mist appears interesting in its bearing on vegetable pathology: in fact, although ammonia in small quantity is favorable to vegetation, a large proportion would be injurious, and would shew its effects especially on the leaves of flowers. Moreover, such a storm might have a deleterious influence on respiration, and especially on the lungs of persons with pulmonary affections.—*Sill. Jour.*

Statistical Society.—London *Dec.* 19.—The Rev. Wyatt Edgell, V. P., in the chair.—"On the Duration of Life among Medical Men," by Dr. Guy.—The author stated that the sources whence he derived the facts which had been employed in obtaining the average results contained in this communication, were:—1. The ages at death of such English medical men, chiefly physicians and surgeons, as had by their writings and high professional reputation secured for themselves a place in the pages of Chalmers's Biographical Dictionary;—2. The ages at death of such English medical men (also chiefly physicians and surgeons) as have found a place in the less select obituaries of the Annual Register, from 1758 to 1848;—and 3. The ages at death of English Medical men (chiefly physicians and surgeons) recorded in the pages of the Biographical Dictionary up to the year 1815, added to the ages at death recorded in the obituaries of the Annual Register from that date up to the year 1852 inclusive. The object of combining the facts derived from these two sources was to bring the data down to the latest period as well as to increase the number of individual facts from which the average results were to be deduced; and he drew the following general conclusions from them:—1st. That the duration of life is greater among physicians and surgeons than among the general practitioners of medicine and surgery:—2nd. That this greater longevity of physicians and surgeons is only in part explained by a less amount of exposure to contagious diseases and other professional risks;—3rd. that the duration of life of members of the medical profession (being chiefly physicians and surgeons,) does not differ materially from the duration of life of the clergy, being somewhat less when the comparison is made between the less distinguished members of the medical profession and clergy whose deaths are recorded in the same obituaries; and somewhat greater when the comparison is limited to the now distinguished members of the two professions;—4th. That the duration of life of medical men has somewhat increased during the last three centuries.

Ruthven's Propeller.—The Enterprise is 100 feet long and has a 16 feet beam; and her tonnage is about 100. Her engines consist of four horizontal cylinders, 12 inches diameter and 2 feet stroke, coupled to a vertical crank shaft. The propeller is composed of a fan wheel, 7 feet diameter, fixed on the lower end of the vertical shaft and revolving in a water-tight chamber; the water flows into this chamber along a covered passage, through a number of small openings in the bottom of the vessel, and is expelled in two continuous streams, by curved pipes, through the sides. The "nozzles," or extremities of these pipes, are only 10 inches diameter, and they are all that protrudes from the surface of the hull, yet the flow of the water through these nozzles furnishes the whole power required for the advance of the vessel. Their best action is obtained when they are entirely out of the water, and they are therefore situated about one foot above the water-line. They are pivotted to the sides of the hull, and are pointed astern when the vessel is to move ahead, or ahead when the vessel is to move astern, or vertically downwards when the vessel is desired to remain at rest. The changes of motion are thus effected with great rapidity, even while the engines continue at full speed, the reversing operation being confined to the rotation of the nozzles.

Now as to the performance. The motion of the vessel is as smooth as that of a canal boat, as the propulsion is continuous, not intermittent, like that of paddles. So remarkable is the smoothness of motion that persons on board the first trip, declared they could not be aware of the motion without looking over the ship's side. The highest speed that has yet been attained is about 12 miles an hour, and this was achieved on the second public trial of the vessel; and we feel confident that, after some obvious modifications of the machinery are completed, we shall reach a speed of 14 miles per hour. The means of quickly reversing enable us to stop the vessel within 50 feet when sailing at full speed: and, by placing the nozzles reversely, one ahead, and the other astern, the vessel may be turned on the spot, swinging on her beam, without the aid of the rudder.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—April, 1854.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Magnet.	Day.	Barom. at tem. of 32 deg.				Tem. of the Air.				Tension of Vapour.				Humidity of Air.				Wind.				Rain in Inch.	Snow in Inch.
		6 A.M.	2 P.M.	10 P.M	Mean.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Mean Vel'y		
						°	°	°	°														
b	1	29·157	29·418	29·683	29·447	36·6	36·0	26·0	32·50	0·194	0·153	0·125	0·155	·90	·78	·86	·83	W N W	W b N	NWbW	12·98	...	0·2
b	2	29·885	29·986	—	—	22·3	32·7	—	—	·106	·163	—	—	86	88	—	—	N N W	NWbW	—	6·26	...	...
b	3	30·157	30·066	·993	30·062	29·3	39·6	34·5	35·03	·140	·147	·174	·158	87	61	88	78	W S W	S b W	Calm	6·87	...	...
...	4	29·886	29·886	·870	29·877	34·1	50·3	34·8	40·27	·176	·239	·176	·204	91	66	88	82	SWbW	S S E	S E	3·08	...	...
b	5	·827	·698	·612	·704	36·3	53·3	42·4	44·65	·196	·348	·242	·259	92	87	90	88	Calm	S W	Calm	3·70	...	...
b	6	·450	·278	·488	·407	41·6	60·3	42·5	47·00	·236	·340	·208	·250	91	66	77	77	Calm	S W	N N W	11·23	0·040	...
d	7	·820	·908	·925	·893	27·3	40·2	33·4	33·53	·121	·192	·166	·162	80	78	87	83	N	S	E N E	5·59	...	...
a	8	·808	·641	·616	·674	35·2	42·7	46·0	41·83	·188	·204	·287	·233	92	74	93	87	E	E	W b S	6·58	0·185	...
a	9	·619	·472	—	—	37·7	40·2	—	—	·207	·208	—	—	91	84	—	—	N E	E b S	—	7·02	0·840	...
f	10	·239	·360	·548	·894	36·6	39·1	35·5	37·32	·204	·205	·184	·199	95	87	89	90	N E b E	N E b N	N N W	8·49	0·105	...
b	11	·743	·725	·708	·720	30·2	41·3	33·2	36·20	·147	·171	·167	·170	88	66	88	81	N b E	S S W	S S W	5·23	...	...
a	12	·744	·707	·719	·719	34·9	53·4	41·6	43·72	·184	·240	·209	·206	91	60	81	74	Calm	S	N	5·08	...	...
a	13	·866	·977	30·060	·977	34·8	37·3	27·5	33·87	·171	·176	·133	·160	85	80	87	84	N N E	E S E	E S E	5·57	...	...
...	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12·24	...	...
a	15	·721	·654	29·674	·674	33·0	37·8	34·1	35·12	·155	·187	·172	·151	82	60	88	74	E	E	E N E	10·23	...	...
a	16	·702	·712	—	—	31·7	39·5	—	—	·148	·169	·	—	83	70	—	—	E N E	E S E	—	10·79	...	...
b	17	·668	·619	·621	·633	34·8	43·7	30·9	37·10	·176	·209	·137	·166	88	74	79	76	N E	S E b E	S b W	5·58	...	...
c	18	·610	·574	·567	·587	36 1	51·1	41·4	44·07	·147	·178	·176	·158	69	48	68	56	S W b S	S b W	S S W	4·38	0·060	...
c	19	·538	·442	·460	·476	36·0	45·7	39·1	42·30	·155	·248	·207	·223	74	82	87	83	S S W	E b N	Calm	2·59	0·070	...
d	20	·419	·448	·530	·469	40·6	50·4	39·8	43·60	·228	·246	·196	·223	91	68	81	80	N E b E	S b W	E b N	3·61	...	...
d	21	·603	·563	·490	·554	36·7	61·0	46·3	48·35	·204	·199	·275	·248	95	37	88	76	N E	E S E	E N E	5·28	0·020	...
c	22	·409	·311	·861	·359	43·4	46·0	48·8	46·12	·249	·270	·330	·283	90	88	97	92	E N E	E N E	N N E	6·64	0·185	...
f	23	·491	·607	—	—	47·5	61·9	—	—	·298	·195	—	—	92	36	—	—	N N E	N b W	—	8·13	...	...
c	24	·756	·649	·557	·640	41·4	57·1	51·7	50·98	·157	·245	·317	·247	61	54	84	67	N N E	S E b S	S b W	2·81	...	...
a	25	·509	·434	·853	·426	45·4	65·1	48·5	54·15	·249	·266	·307	·292	83	43	91	73	S S W	S E b E	N E b E	3·93	0·630	...
c	26	·255	·090	·196	·173	46·0	53·9	48·2	50·23	·287	·352	·308	·327	94	87	93	91	N E b E	S E b E	N	6·85	0·375	2·0
c	27	·388	·576	·732	·581	33·0	38.8	35·2	33·63	·175	·152	·180	·166	94	79	88	87	N E b N	N E b N	N E b N	11·25	...	0·5
b	28	·940	·996	30·023	·995	29·9	42·0	35·7	36·48	·141	·144	·158	·144	84	55	76	68	N N E	N E	N b E	10·30	...	...
b	29	·995	·881	29·780	·869	37·7	39·0	34·5	37·32	·197	·186	·188	·194	87	79	95	88	N E b N	N E	N N E	8·21	0·070	Inap.
b	30	·676	·606	—	—	37·1	44·5	—	—	·205	·240	—	—	94	83	—	—	N b E	S W b S	—	4·18	0·105	...
																		Miles.	Miles.	Miles.	Miles		
	M	29·646	29·621	29·648	29·6379	36·29	46·65	38·82	41·04	0·187	0·219	0·209	0·207	86	69	86	80	6·95	8·64	5·18	6·82	2.685	2·7

Highest Barometer.. 30·233, at 6.30 a.m. on 14th } Monthly range:
Lowest Barometer... 29·045, at 4 p.m. on 26th } 1·188 inches.
Highest temperature.. 65°·1, at 2 p.m. on 25th } Monthly range:
Lowest temperature... 20°·2, at a.m. on 2nd } 44°·9.
Mean Maximum Thermometer.............. 47°·82 } Mean daily range:
Mean Minimum Thermometer............. 30°·69 } 17°·13.
Greatest daily range............... 35°·4, from p.m. 6th to a.m. of 7th.
Warmest day....... 25th. Mean temperature...... 54°·15 } Difference,
Coldest day......... 1st. Mean temperature...... 32°·50 } 21°·65.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
2083·06	854·00	1030·89	2261·73

Mean direction of the Wind E 37° N.
Mean velocity of the Wind... 6·82 miles per hour.
Maximum velocity....... 20·2 miles per hour, from 3 to 4 p.m. on 1st.
Most windy day...... 1st; Mean velocity... 12·98 miles per hour.
Least windy day...... 19th; Mean velocity... 2·59 ditto.
Raining on 12 days. Raining 41·8 hours. Depth, 2·685 inches.
Snowing on 4 days. Snowing 8·9 hours. Depth, 2·7 inches.
Thunderstorms occurred on the 8th, 9th, 21st, 25th and 26th.
Aurora observed on 8 nights.
Possible to see Aurora on 15 nights.
Impossible to see Aurora on 15 nights.

5th. Frogs heard in the river Humber.
6th. Butterfly seen in Observatory grounds.
8th. Toronto Bay clear of ice.
9th. Flocks of wild geese passing over the Observatory from South towards North.
10th. Splendid Aurora from 9 p.m. of 10th to 3 a.m. of 11th, during which the magnetic disturbance much surpassed that which occurred during the great Aurora of the 27th ult.
14th. Swallows observed.
25th. Wild pigeons numerous, and passing northward.
26th. Thunderstorm from 3.55 to 7.45 p.m., during which very heavy rain and hailstones fully ⅜ of an inch in diameter fell, and a very beautiful and perfect double rainbow with supernumary bands was formed.

Comparative Table for April.

Year.	Temperature.				Rain.		Snow.		Wind.	
	Mean.	Max. obs'vd.	Min. obs'vd.	Range.	D's.	Inch.	D'ys	Inch.	Mean Vel'y.	
	°	°	°	°						
1840	42·7	65·9	25·3	40·6	14	3·420	2	Not Regis'd.	...	
1841	39·2	62·9	22·1	40·8	3	1·370	3		0·51	lb.
1842	43·1	89·5	21·6	67·9	8	3·740	2		0·57	lb.
1843	40·9	70·0	15·1	54·9	7	3·185	3	0·1	0·46	lb.
1844	47·5	74·5	17·2	57·3	10	1·515	1	Inap.	0·24	lb.
1845	42·1	66·0	14·8	51·2	11	3·290	4	1·5	1·00	lb.
1846	44·0	79·4	24·4	55·0	10	1·300	2	1·3	0·55	lb.
1847	39·2	65·6	8·4	57·2	8	2·870	2	4·0	0·59	lb.
1848	41·3	65·4	26·5	38·9	5	1·455	1	0·5	4·89	Miles.
1849	39·0	70·9	23·2	47·7	10	2·655	2	1·7	7·50	Miles.
1850	37·9	63·2	18·2	45·0	7	4·720	2	1·1	7·64	Miles.
1851	41·3	59·2	25·8	33·4	11	2·295	3	1·2	8·07	Miles.
1852	38·2	53·8	19·8	34·0	6	1·990	4	9·4	6·68	Miles.
1853	41·9	65·7	27·0	38·7	10	2·625	1	1·0	5·20	Miles.
1854	41·0	65·1	22·3	42·8	12	2·685	4	2·7	6·82	Miles.
									0·56	lb.
M'n.	41.29	67·81	20·78	47·03	8·8	2·608	2·4	2·04	6·69	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—April, 1854.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 *deg.* 32 *min. North. Longitude*—73 *deg.* 36 *min. West. Height above the Level of the Sea*—118 *Feet.*

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			6 A.M.	2 P.M.	10 P.M.
1	28·948	29·000	29·216	39·0	41·4	33·0	·234	·235	·178	·91	·85	·86	N b E	W S W	W N W	14·60	9·43	11·69	0·410		Rain.	Rain.	Cum. Str. 8.
2	29·620	·602	·771	19·0	29·2	22·0	080	152	096	64	85	68	W b N	W S W	W b N	20·00	11·50	3·88			Clear.	Clear.	Clear. [Lights.
3	·902	·800	·741	27·2	42·1	28·3	112	208	153	67	73	88	S W b W	S W b W	S S W	0·15	2·25	11·33			Do.	Cir. Str. 8.	Do. Comet vis-
4	·661	·606	·518	33·0	50·1	29·0	187	326	161	90	87	89	S S W	S S W	E	0·21	Calm	Calm			Str. 10.	Str. 10.	Str. 2. [ible.
5	·652	·418	·370	35·0	55·0	40·0	186	372	246	83	84	92	S S W	S S W	S S W	1·51	1·07	2·14			Clear.	Cir. Str. 8.	Do. 10.
6	·216	·080	·040	43·2	54·0	43·5	252	373	280	85	87	94	W S W	W S W	S W	1·25	1·60	14·72	0·400		Cir. Str. 8.	Str. 10.	Rain at 5 p.m*
7	·421	·600	·691	31·0	39 0	26·6	171	214	137	89	84	82	N W	W b N	W b N	13·75	3·25	Calm	0·110		Clear.	Clear.	Clear. Comet
8	·614	·515	·461	26·0	31·0	28·8	123	178	170	76	92	94	N b E	N E b E	N E b E	0·85	6·75	6·50		1·40	Str. 10.	Snow.	Snow. [visible
9	·462	·314	·255	31·4	38·2	32·1	171	203	191	89	91	95	N E	N E b E	N E b E	8·75	6·22	16·66			Do. [8 a.m.	Cum. Str. 8.	Rain at 9.10
10	·126	·210	·246	33·8	44·0	36·0	204	261	210	95	85	91	N E b E	N E b E	N b E	11.57	10·21	3·00	1·570		Rain ceased at	Str. 10.	Cir. 4.† [p.m.
11	·431	·453	·420	26·7	47·6	32·8	137	291	187	83	86	90	N b E	S S W	S W b S	9.72	3·56	0·22			Clear.	Clear.	Clear.
12	·451	·614	·422	35·0	53·5	40·0	203	238	194	91	57	73	W S W	W b S	N E	2 67	0·68	0·62			Do.	Do.	Cir. Cum. 4.
13	·708	·680	·772	25·4	39·4	24·6	135	227	112	86	85	71	N N E	S E b S	E S E	2 75	5·78	Calm			Do.	Do.	Do.
14	·939	·770	·701	16·5	36·0	24·6	096	171	135	83	74	86	N E b N	S S E	N E b E	1·03	0·12	0·11			Cir. 4.	Cir. 2.	Clear. Aurora
15	·597	·520	·508	21·0	36·3	28·6	118	192	152	88	83	85	N E b E	N E	N b E	2·50	8·02	1·58			Cir. Str. 4.	Clear.	Do. [Borealis.
16	·597	·512	·526	22·2	41·2	30 2	123	217	160	88	79	86	N N E	N N E	N N E	6·21	Calm	4·99			Clear.	Do.	Do.
17	·554	·408	·343	27·0	41·9	34·7	146	230	178	87	83	83	N N E	N E b N	N E b N	3·06	6·93	4·80			Do.	Cum. Str. 8.	Str. 10.
18	·353	·240	·182	29·6	53·6	40·1	137	337	198	70	81	75	N E b N	S b W	S b W	4·92	1·01	0·08			Do.	Clear.	Do. 1.
19	·261	·166	·215	36·6	54·2	38·0	182	326	217	76	76	86	W b S	W S W	W b S	0·76	2·54	4·50			Hazy.	Do.	Do. 4.
20	·233	·203	·278	37·3	56·0	43·1	218	412	270	91	84	91	W b S	W	S W	1·12	Calm	0·55			Clear.	Cir. Cum. 4.	Do. 2.
21	·389	·318	·423	31·8	62·5	42·2	182	421	243	91	75	85	N b E	S b W	S S E	0·11	Calm	Calm			Do.	Clear.	Clear. Aurora
22	·350	·235	·240	38·7	50·5	40·0	214	326	227	84	87	85	N E b E	N E	N E	0·07	2·13	2·94			Cir. Cum. Str.	Cir. Str. 10.	Str. 8. [Bo.
23	·298	·414	·423	40·0	53·0	40·2	210	315	194	79	76	73	N E b N	N E	N	8·38	10·60	1·26			Clear. [8.	Clear.	Clear. Do.
24	·491	·366	·426	37·2	59·0	45·0	167	338	218	70	66	69	N b W	W b S	S W b W	0·66	1·26	1·26			Do.	Do.	Str. 2. Do.
25	·416	·410	·479	44·0	65·2	49·2	241	381	290	79	61	80	W S W	S W	N N E	4·55	0·75	5·79			Do. [at 6 40.	Cir. 2.	Do. 4.
26	·410	·309	·498	41·7	41·2	41·0	235	253	235	85	91	85	N E b N	N E b E	N N E	2·00	4·51	2·03	0·180		Str. 10. Rain	Rain.	Do. 10.‡
27	·500	·492	·490	32·0	34·2	32·1	160	186	160	80	87	80	N N E	N E b E	N N E	7·69	11·18	Calm		1·73	Do. Snow at	Snow.	Do. 9.§
28	·384	·376	·498	30·0	44·5	33·6	160	207	187	86	68	90	N N E	E b N	E b N	13·51	11·37	4·62		1·00	Snow. [8 a.m.	Str. 9. [a.m.	Str. 4.
29	·478	·464	·456	31·7	34·2	33·5	182	204	205	91	95	96	N E b E	N E b E	N E b E	Calm	3·25	24·47	1·390		Str. 10.	Rain at 11.40	Rain.
30	·478	·486	·512	40·0	47·2	43·0	251	291	282	95	86	94	N E b E	N E	E N E	15·78	0·21	Calm	3·826		Rain.	Str. c'd at noon	Str. 10.

Barometer	Highest, the 14th day	29·939
	Lowest, the 1st day	28·948
	Monthly Mean	29·440
	" Range	·991
Thermometer.	Highest, the 25th day	67°·6
	Lowest, the 14th day	15°·4
	Monthly Mean	37°·75
	" Range	52°·2
	Mean Humidity	·835

Greatest Intensity of the Sun's Rays .... 134°·0

Temperature of the month 3°·61 below that of last year.

Amount of exporation, 1·86 inches.

Rain fell on 7 days, amounting to 7·886 inches. Raining 49 hours 10 minutes, accompanied by lightning on 1 night.

Snow fell on 3 days, amounting to 4·03 inches.

Most prevalent Wind, N E b E. Least prevalent Wind, E.

Most Windy Day, the 2nd day; mean miles per hour, 11·79.

Least Windy Day, the 21st day; mean miles per hour, 0·03.

Aurora Borealis visible on 5 nights. Might have been seen on 8 nights.

Lunar halo visible on 1 night.; diameter, 60°.

Comet seen here for several nights; on the 7th at 8 p.m. R. on 3h. 35m. 31s. Declinature, S = 7°20·0.

Swallows first seen on the 12th day. First steamboat at Montreal on the 22nd day.

Electric apparatus out of order until the 20th day. Since that date the electrical state of the atmosphere has been marked by feeble intensity of positive electricity, and during the snow storm of the 27th day indicated high tension.

* Ceased at midnight. † Lunar halo; diameter, 60°. ‡ Rain ceased at 4 p.m. § Snow ceased at 3 p.m.

SUPPLEMENT

TO

The Canadian Journal

FOR JUNE, 1854.

Statistics of Upper Canada.

In the year 1840, a paper was published in the "British Colonist," headed "Lands and Population in the United States and Upper Canada." The author of that document now brings it again before the public in the *Canadian Journal*. He conceives that its republication *in extenso* will be interesting in the present history of this Province, if accompanied by a statement and remarks applicable to the period, and showing how far the expectations entertained fourteen years since have been realized. Those assumed results in 1840 were considered by many people as visionary, and based upon imperfect data. The period selected for the application of the principle set forth in the paper referred to, is from the year 1840 to 1852, and consequently freed from the beneficial influences of the railroads and other great improvements now in progress, and which must necessarily operate in an extraordinary manner in promoting an increase to our population, wealth, and importance.

It was desired to follow out the consequences of the increased population, as bearing upon the quantity of land placed under cultivation, and showing also its greatly enhanced value. And this would have been an extremely interesting subject, the reasoning under Section III. being so very applicable to the actual position of Canada in reference to Great Britain; but there is at present no sufficient reliable data upon which to proceed with safety. It is not apart, however, from the subject herein treated upon, to exhibit the advantages the Province has derived in a pecuniary point of view from the migratory emigration passing through this country.

It was only in the year 1831 that a systematic arrangement was made by the Canadian Government for receiving, arranging, and recording the numbers of emigrants which flocked to our shores, and it was not till after the devastation caused by cholera in 1832 and 1834 that the absolute necessity appeared of affording Government assistance (first by money and afterwards by superintendence) in the spreading of settlers, placing new comers amongst our population, and the rapidly pushing forward of those who made the passage by Quebec and our great Lakes their highway to the Western States. Since that time the most accurate registration of the numbers of emigrants has been kept, and the strenuous exertions of the Government have been directed to promote the rapid settlement or passage, as the case might be, of the newly arrived emigrants.

It was important, in every respect, to ensure a quick passage through our Lakes, rendering the route a favourite one to those bound for the far west, and who were thus benefited to a great extent by their transit. Speedy dispersion and settlement in Canada was still more important, not only in a sanitary point of view, but as it placed those who could ill spare the time in looking for employment at once amongst their employers, and enabled them to send aid to the British Isles, to assist their friends requiring aid to follow them.

The benefits as to increase in population which Upper Canada has derived from emigration have been overrated, and the amount of transient emigration which has used our canals and Lakes and river navigation has been very little understood—nor could it be, until, by the results of the census, we could form even a speculative opinion as to the numbers which had passed through the Province.

The entrance of the emigration through the water gate of Quebec gave us, to a fraction, the *arrivals;* but it required time and the official census to ascertain how many of those who arrived, remained as settlers, contributing to our prosperity, and how many merely benefited us by the expenditure of their cost of passage through our waters. As we said before, it was easy to number the arrivals at Quebec, and to follow them through the St. Lawrence; but once on the Lake, information upon their future routes became almost inaccessible, for the outlets were too numerous to be watched, and the course of the emigration could only be guessed at.

Not to go too far back and tire our readers—it will be sufficient for our purpose if we start from the year 1840. The number of emigrants arrived since then are as follows, viz.:—

In the year 1840	21,190
.. 1841	28,937
.. 1842	44,374
.. 1843	20,142
.. 1844	25,375
.. 1845	29,253
.. 1846	32,736
.. 1847	90,150
.. 1848	27,939
.. 1849	38,494
.. 1850	32,292
.. 1851	41,076

The population of Upper Canada was in 1840, 460,000. Now, if we yearly add to this amount the number of emigrants arrived in the Province, and deal with them in conformity with the principle of the afore-mentioned table, the result will show us whether the opinions hitherto entertained, namely, that nearly, if not quite all, who arrived remained, or that, if some did pass on, their numbers were made up by emigrants from the States, was well grounded or not.

The result we arrive at is 1,229,214—showing that the before-named opinion would be incorrect, as had those numbers remained in the Province, the actual population should be 277,210 *more* than is given in the census.

We must therefore try again, and assume that one-half of the emigration settled in Canada, and the other half passed on, or died on their passage, and make the calculation accordingly.

The result, according to the principle of calculation laid down in 1840, shows that the population of Upper Canada should have been in the year 1852, 962,238, whereas the official census shows it to be 952,004.

Thus it appears that the anticipations entertained fourteen years since, fall short in amount to the extent of 10,234 only, thus establishing with extraordinary accuracy the correctness of the rule laid down in the year 1840, and more particularly so, if, as is believed, the census is imperfect, and that a precise return would have exhibited the number of our population to be considerably larger than is set down in that official statement.

The table also proves that one-half only of the emigrants who have arrived in Canada since 1840 to 1852, have made this

Province their permanent abode, a result which may astonish those who have not considered the subject under all the circumstances bearing upon it.

With respect to the one half of the emigrants who have passed on to the United States (excepting those who have perished from fever or cholera, being, it is hoped, only a small proportion of the number), the benefit of the cost of their passage through our waters is all they have left to us, but as this, on the average, has been £1. 6s. 3d. per head, exclusive of provisions, from Quebec to Buffalo, it amounts to £308,672 15s. 0d. add thereto 15s. per head for provisions, &c., and we have a sum total expended in this Province, during twelve years, by this transitory people, of £485,345 15s. 0d.

The emigration of 1852 was 39,176. In the last calculation, viz., of the advantages derived to the Province by the passage of that portion of emigrants who have passed through, we make use of one-half that number as they have actually benefited the Province by the cost of their transport; but in the former calculation, the emigration of 1852 is not included.

Since this document has been framed, the official returns of immigration of the *past* year (1853) have been issued in England, which show the arrivals in Canada to have been 36,699 souls, of which 11,504 passed through to the United States: 200 of the Norwegians destined for Wisconsin accepted employment at Hamilton. It is also assumed in the returns that 5000 immigrants arrived in the United States for Canada; and a number of railway labourers had passed on to Canada, attracted by the abundant employment at high wages in the Province, and the cessation of work in the Western States.

There is something (De Tocqueville observes) extremely grand and solemn in watching "this great wave of population," which annually takes its rise in the heart of Europe, rolls across the Atlantic Ocean, and, after breaking upon the shores of North America, swells the current of another and a mightier stream, which has flowed onward until it has partially peopled the almost boundless region of the "Far West," and reached the coasts of the Pacific. There are but few passages in English poetry more beautiful than that written by Wordsworth about forty years since, when the "Bees" that left the "thronged hives of Britain" were few in number, and the "new communities" they were forming were comparatively unimportant and feeble, nor do we think we can do better than close these few remarks by quoting the lines referred to:—

"As the element of air affords
An easy passage to the industrious bees,
Fraught with their burdens ; and a way as smooth
For those ordained to take their sounding flight
From the thronged hive, and settle where they list—
In fresh abodes their labour to renew ;
So the wide waters open to the power,
The will, the interests, and appointed needs
Of Britain, do invite her to cast off
Her swarms ; and, in succession, send them forth,
Bound to establish new communities
On every shore whose aspect favours hope,
Or bold adventure ; promising to skill
And perseverance their deserved reward.
Change, wide and deep, and silently performed,
This land shall witness ; and, as days roll on,
Earth's universal frame shall feel the effect,
Even to the smallest habitable rock
Beaten by lonely billows, hear the songs
Of harmonized society, and bloom
With civil arts that send their fragrance forth,
A grateful tribute to all-ruling Heaven.
Book IX., Excursions.

Lyndhurst, Toronto, 1st June, 1854.

Lands and Population in the United States and Upper Canada.

[*Extract from a Tract written and published in the year* 1798, *by a gentleman who held an important official situation in the Government of the United States, entitled, "Facts and Calculations respecting the Population and Territory of the United States of America."*]

SECTION I.

OF THE POPULATION OF THE UNITED STATES.

It is well known that, about a century ago, the country which now composes the United States of America, contained but a few thousand civilized inhabitants, and that now the same country contains four or five millions.

But the causes of this vast increase in numbers seem not to be equally well understood. It is believed that many persons still suppose the population of America to be chiefly indebted for its growth to emigrations from other countries, and that it must become stationary when they cease to take place. Some facts and calculations will be here set down, to ascertain the ratio of the natural increase of the inhabitants of America, and to show that the great progress of wealth and population in that country is chiefly derived from internal causes, and of course less liable to interruption from without.

The highest estimate that is recollected of the number of inhabitants removing to America in any one year supposes the number to be 10,000.* If the same number had removed every year since the first settlement of the country, it would make the whole amount to 1,600,000. But it is to be remarked, that this estimate was made for a period when emigrations were unusually numerous—that during the many years of war which have taken place they have been very few; and that in former years, when the number of emigrants was complained of *as an evil*, it was not reckoned so high.† We may, therefore, suppose that 5000 persons per annum is a liberal allowance for the average number of persons removing to America since its first settlement. This, in the year 1790, would amount to 800,000 persons. At the end of 1790, and beginning of 1791, there were enumerated in the general Census the number of 3,993,412 inhabitants.‡ As some places were not enumerated at all, and from others no return was made, there can be little doubt but the actual number then was something more than 4,000,000. Supposing them to have increased so as to have doubled their numbers once in twenty years, then in the several preceding periods of twenty years since the year 1630 the numbers would stand thus:

At the end of 1790,	4,000,000	At the end of 1690,	125,000
" " 1770,	2,000,000	" " 1670,	62,500
" " 1750,	1,000,000	" " 1650,	31,250
" " 1730,	500,000	" " 1630,	15,625
" " 1710,	250,000		

But as this last date reaches back to the infancy of the first settlements in North America, it can hardly be supposed that they contained so many as 15,000 inhabitants. It follows, therefore, that they must have doubled their numbers oftener than once in twenty years; that is, that they must have increased faster than at the rate of 5 per cent., compounding the increase with the principal at the end of every twenty years.

To determine how far this rate of increase is justified by other

* "*Cooper's Information*," &c.
† "*Douglas's Summary*," Vol. II., p. 36.
‡ See the Census of 1791.

facts, some pains have been taken to ascertain and compare the number of inhabitants at different periods, viz., 1750, 1774, 1780, and 1791.

Here follows the estimate and the results, showing that in the year 1750, the total of inhabitants in the thirteen colonies was 1,179,259—1790, the whole number in the thirteen States, 4,000,000, being about 34-10 times the number of 1750. If this increase be computed in the manner of simple interest, it affords a ratio of 5-98, or very nearly 6 per cent., or in the manner of compound interest, of between 3 and 3½ per cent. Any number increased in the compound ratio of 3 per cent. per annum, is doubled in about 23½ years, and at 3½ per cent., in about 20 years; that is, it is equal to 5 per cent. simple increase for the same period.

In 1782 a return was made to Congress of the inhabitants in the several States, by which there appeared to be 2,389,300. This return was then believed to be accurate, for it was made the rule for the assessment of public burthens among the States; but, in 1784, the accuracy of it was attacked by Lord Sheffield, who affirmed it was too great. If it was, in fact, as much too great as he supposed, then the increase of numbers from that time to 1790 must have exceeded all credibility. But allowing it to have been accurate, the

Difference between the number, 1790............		4,000,000
And the number, 1782...............................		2,389,300
Is..		1,610,700
From this deduct for emigrants, viz., 10,000 emigrants per annum for 9 years......	90,000	
Increase of ditto at 5 per cent. 4½ years...	20,250	
		110,250
Natural increase in 9 years.........................		1,500,450

which, calculated upon the number of inhabitants returned in 1782, gives the astonishing natural increase of 6-97, or very nearly 7 per cent. per annum.

From these statements, compared with each other, it appears that in the year 1790 the actual increase of inhabitants in the United States, beyond the number ever imported,* must have been 3,200,000, or, after the most liberal allowances, at least 3,000,000; that the whole rate of increase upon the numbers at any given period has been more than 5 per cent., and, deducting for emigrations, that it has been equal to about 5 per cent. for any twenty years successively, or 3½ per cent. compound increase for any period that has yet elapsed.

But it may be said, no inference as to the future population of America can be derived from these facts, because, as the country becomes more thickly settled, the increase will be slower. We have an opportunity of examining what weight the objection possesses.

The Eastern States are the most thickly inhabited. The greater part of the emigrations from them have been either to other States in New England, or to the State of New York.

In 1750, New England and New York together contained 444,000—in 1790, 1,348,942, having more than trebled their numbers in 40 years, and increased during all that period at the rate of more than 5 per cent. upon their original number, and in the compound ratio of nearly 3 per cent.; and as many more persons have emigrated from these States than have come into them from abroad. All this, and *something more*, is their natural increase.

In 1750, Massachusetts contained 32 persons, and in 1790, about 60 persons to each square mile;

In 1750, Connecticut contained 20 persons, and in 1790, about 50 persons to each square mile;

In 1750, Rhode Island contained about 23 persons, and in 1790, about 52 persons to each square mile; so that, besides the numerous emigrants these States have sent forth, they have more than doubled their numbers in 40 years, and nearly trebled them since they contained 20 persons to each square mile.,

Mr. Jefferson took some pains to prove that the inhabitants of Virginia double their numbers once in 27¼ years. He also proved, by an ingenious calculation, that in 1782, the numbers in Virginia were 567,614; in 1790, the same country (part of which made the State of Kentucky) contained 821,287, giving an increase of 496-100, or very nearly 5 per cent., and doubling their numbers, not in 27¼ years, as Mr. Jefferson sought to prove, but in less than 21 years. Virginia (exclusive of Kentucky) added about 180,000 to its numbers between 1782 and 1790, the period when the numerous emigrations to Kentucky caused so great a drain upon its population.

In 1780, the number of militia west of Blue Ridge in Virginia was 11,440, which, multiplied by four, gives for the number of inhabitants 45,760. In 1790, the same county contained 151,235, those counties having more than trebled their numbers in 10 years.

The writer then proceeds to say, it is to be observed that these facts (and many more of a similar tendency might be adduced) are drawn from the former and least prosperous state of America, and from periods which were either absolutely those of public calamity, or at best were not those of national prosperity; yet, it is apprehended they sufficiently prove that the inhabitants of the United States increase at least as fast as at the compound ratio of 3½ per cent.; that should foreigners cease to remove there, it would not prevent more than 1-15 or 1-20 of this increase, and that there are as yet no symptoms of this rate of increase being at all diminished by the crowded population of the country. The United States must contain 18,000,000 of people to equal the average of New England, and 55,000,000 to equal the rate of population in Massachusetts and Connecticut.

The causes of this great increase of population, so peculiar to America, might be readily and satisfactorily explained by a review of the state of manners, society, property, &c., in that country. This discussion is, however, unnecessary for the object entertained.

Here follow the calculations showing the increase of population since 1790 to 1797, at the ratio of 3½ per cent. per annum, compounding the increase with the principal every year. They result in exhibiting that the population of the United States in 1797 was 5,088,890.

SECTION II.

ON THE TERRITORY OF THE UNITED STATES.

From the statements in Section I., it appears that the increase of the inhabitants of the United States is in the compound ratio of about 3½ per cent, and that at the end of 1797 their numbers were 5,088,890. The territory of the United States has been usually reckoned, after Mr. Hutchins, as equal to a tract of

* Various authorities are quoted from which these data are taken.

1,000,000 square miles. This computation, though probably too large, will be followed.

It gives in acres, 640,000,000; from which deduct for water, 51,000,000, and there remains of land, 589,000,000. Of this quantity it is known that about 220,000,000 are contained in the territory north-west of the river Ohio, and is nearly all of it uninhabited. Of the 369,000,000 which remain, it is difficult to form any just estimate as to the proportion of the inhabited and appropriated parts to those which are not so. It is, however, thought reasonable to suppose that, in America, whenever any part of the country has acquired a population of about 20 persons to the square mile, or 150 to 200 acres to a family, that then the land must there have acquired nearly the average price of cultivated land, and the surplus population will incline to emigrate. Assuming this as a rule, the lands in the United States so occupied would, in 1796, be 157,337,664—remains, 211,662,336 a great part of which is inhabited in some degree. The remainder is owned by States and individuals, and much of it not for sale. Add for the North-west territory, 220,000,000 Land of all kinds yet to be settled, 431,662,336.

The increase of the population of the United States, calculated upon the principles established in Section I., will, if applied to the settlement of new lands, at the rate of 20 persons to each square mile, or 32 acres each person, occupy the lands of the United States in the proportion, and at the periods following, viz.:—

YEAR.	Number of inhabitants.	Acres of land occupied by the increase.	Acres of land remaining unoccupied.
1796	4,916,802	......	431,662,336
One year's increase.......	......	5,506,816	......
1797	5,088,890		426,155,520
Ten ditto....................	......	66,863,712	......
1807	7,178,381		359,291,808
Ten ditto....................	......	94,317,856	......
1817	10,125,814	......	264,973,952
Ten ditto....................	......	133,044,704	......
1827	14,223,461	......	131,929,248
Seven ditto..................	......	131,929,248	......
About 1834	18,406,150	......	000,000,000

SECTION III.

OF THE VALUE OF LANDS.

It has usually been supposed that the great rise which has taken place in the value of American lands, has been produced by caprice or accident, and not derived from any fixed and certain sources of profit; but it is allowed that this rise in their value has been constant, and very great ever since the first settlement of the colonies, and during periods which were far from being those of public prosperity. Without taking advantage, however, of the present favorable state of public affairs, it will be attempted to show, from facts and calculations drawn from the former and least prosperous state of the country, that the great increase in the value of lands is derived from fixed and necessary causes existing in the country, and is, in a great measure, subject to strict calculation. The following calculation is founded upon these principles:—

1st. It is supposed to be proved in Section I., that the inhabitants of the United States increase in the compound ratio of 3½ per cent.

2nd. It appears from the same Section that, at the end of the year 1796, the number of inhabitants in the United States is about 4,916,802.

3rd. It appears from the statements in Section II., that the quantity of vacant lands in the United States is about 431,662,336 acres.

4th. Of consequence there are in the United States 1,139 persons to each 100,000 acres of new lands.

5th. It is supposed that new lands on an average are worth one dollar per acre; and that lands inhabited at the rate of twenty persons to the square mile, are worth thirteen dollars or three guineas per acre.

The following statement, therefore, shows the increasing value of any 100,000 acres (taken equal to the average) upon the principle that the increase of 1,139 persons may be applied to the settlement of it; and that as much land as they settle at the rate of twenty persons to the square mile is worth thirteen dollars or three guineas per acre:—

YEAR.	No of Inhabitants.	Lands annually occupied by an increase of Inhabitants.	Value of 100,000 acres each year.	Value per Acre.	The same in Sterling.
		Acres.	Dollars.	Dlls. Cts.	£ s. d.
End of 1796	1,139	....	100,000	1.00	0 4 6
Increase	40	1,280	16,640		
End of 1797	1,179	1,312	116,640	1.16	0 5 2½
Increase	41	....	17,056		
End of 1798	1,220	1,344	133,696	1.33	0 5 11¾
Increase	42	....	17,472		
End of 1799	1,262	1,408	151,168	1.51	0 6 9½
Increase	44	....	18,304		
End of 1800	1,306	1,472	169,472	1.69	0 7 4¼
Increase	46	....	19,136		
End of 1801	1,352	1,504	188,608	1.88	0 8 5¼
Increase	47	....	19,552		
End of 1802	1,399	1,568	208,160	2.02	0 9 4¼
Increase	49	....	20,384		
End of 1803	1,448	1,631	228,544	2.28	0 10 3
Increase	51	....	21,216		
End of 1804	1,499	1,664	249,760	2.49	0 11 2¼
Increase	52	....	21,632		
End of 1805	1,551	1,728	271,392	2.71	0 12 2¼
Increase	54	....	22,464		
End of 1806	1,605	1,792	293,856	2.93	0 13 2¼
Increase	56	....	23,296		
End of 1807	1,661	....	317,152	3.17	0 14 3
" 1808	1,719	1,856	341,280	3.41	0 15 4
" 1809	1,779	1,920	366,240	3.66	0 16 5¼
" 1810	1,841	1,984	392,030	3.92	0 17 7¼
" 1815	2,186	11,040	535,550	5.35	1 4 0¾
" 1820	2,596	13,120	706,110	7.06	1 11 9
" 1825	3,083	15,584	908,702	9.08	2 0 8¼
" 1830	3,661	18,784	1,152,894	11.52	2 12 10
" 1834	4,255	19,008	1,400,000	13.00	3 3 0

It is not intended by this statement to convey the idea that the rise in the value of any particular tract of land will be in the exact proportion here mentioned. In many important instances in America it has been greater, in others, perhaps, less. But it is intended to show that the increase in the value of American lands is, in its nature, like that of compound interest; and that, assuming the very moderate ratio of 3½ per cent. for the increase of inhabitants, the general rise in the value of property resulting therefrom, is very far above the profit of capital in any of the ordinary ways of employing it. And it is to be remembered that these statements being matters of arithmetical calculation, are not to be disproved, except by disproving some of the premises on which they are founded.

It ought also to be remarked that the statement is burthened by the inclusion of all the lands in the United States, and, of course, of many millions which are not now for sale, and will not begin to be settled for many years. It is, therefore, much too moderate if considered with respect to the lands now in market.

The lowest price at which Congress sell the lands they offer for sale is two dollars per acre. The astonishing low prices of lands in America have hitherto been occasioned by the want of capital to invest in them. Only a few European capitalists have lately understood the subject; and nobody is ignorant of the immense advantages they have derived from it. The great increase of capital in America, together with the investments which Europeans are beginning to make in lands, will probably raise their value far above the rate at which it has increased at any former period.

Such a conclusion results not unnaturally from another consideration, which is this: The price of any commodity whatever may be raised in two ways; either by diminishing the quantity for sale, or by increasing the demand. But the extension of settlements and the increase of wealth and population operate at once in both these ways upon American lands; not only diminishing the quantity for sale, but increasing the means and the eligibility of making further purchases and settlements.

The Republic, as is well known, consisted of thirteen States in 1790, viz.: Massachusetts, Maryland, New Hampshire, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Virginia, New Carolina, South Carolina, and Georgia. The preceding statement has, of course, reference to these thirteen enumerated States only; subsequently the Republic has been extended to twenty-four States by the addition to the Union of the following eleven States, viz.: Maine, Vermont, Ohio, Tennessee, Mississippi, Indiana, Illinois, Missouri, Alabama, Louisiana, and Kentucky. To these might be added the territories of Michigan, Arkansas, Florida, and the District of Columbia.

In considering the accompanying statement and calculations founded thereon, although they may not at first view appear to have realised in 1834 the anticipations of the author, who penned them forty years since, many events and the consequences arising out of them have occurred, which have most materially affected the contemplated result; it may tend to illustrate the actual position of the case by bringing forward those events which bear in favour, and also those which bear against the statement. In favour of the statement:—

For some time, especially during the wars with England in 1812 to 1814, there was scarcely any immigration into the United States. On the contrary, there were considerable emigrations from thence to Canada, &c., nor would a state of war tend to promote any natural increase of the population.

The vast extension of the dominions of the Republic by the acquisition of Florida, the annexation of other States and territories since 1790, would necessarily postpone the settlement of all the lands in the manner anticipated, and also generally keep down their prices most materially. (1) But yet the average prices of settled land is supposed to far exceed thirteen dollars, or three guineas per acre. (2)

Against the statement:—

The population of the United States did not amount to 18,000,000 of inhabitants in 1834, being only 12,866,020 at the last census in 1830. (3)

The number of immigrants into the United States has been very considerable during the last 20 years—especially during the last 10 years.

To draw these observations to a point, the object had in view in extracting and condensing the annexed statement (although sufficiently interesting in itself, if proved to be tolerably correct—due allowances being made for the unforeseen circumstances) was to endeavour to draw a parallel statement of the prospective position of Upper Canada, in a given number of years, founded upon accessible data.

The population of Upper Canada, in 1838, was 400,000 inhabitants. (4)

Within the actual limits of Upper Canada, between the parallels 41°, 47°, and 49° of north latitude, there are 141,000 square statute miles. (5)

Assuming that only that portion of the territory embraced by, and on the south of French River, Lake Nepissing, and the Ottawa River, is available or suitable for agricultural purposes, and that the territory beyond those limits will only be settled when the population of the south shall become very dense, and making allowance for the superficies covered by water, it will not be underrating the quantity of land at present considered available, in estimating it at about one-third less than the whole territory, but say, for the purpose of this statement, at 100,000 square statute miles. (6)

Thus it appears there are now 160 acres to each inhabitant.

A recent intelligent Canadian writer (7) considers the territory suitable for settlement at 35,326,400 acres, after deducting 16,000,000 for water.

Thus it appears there are 88½ acres to each inhabitant.

The annexed table will show that to settle the 100,000 square statute miles, or the 64,000,000 statute acres, in the proportion of 20 persons to a square mile, or 32 acres to each individual, will require 2,000,000 inhabitants. (8)

It will take 47 years, unassisted by immigration, compounding the natural increase with the principal, at three-and-a-half per cent. per annum, to settle 100,000 statute miles.

40 years assisted	annually	by	5,000	immigrants.
35	ditto	ditto	10,000	ditto.
32	ditto	ditto	15,000	ditto.
29	ditto	ditto	20,000	ditto.
26	ditto	ditto	25,000	ditto.

The table will also show the number of years it will take to settle in a like manner the 35,326,400 acres, and which will require 1,103,950 inhabitants.

It will take 30 years unassisted by immigration.

25	years assisted annually	by	5,000	immigrants.
21	ditto	ditto	10,000	ditto.
18	ditto	ditto	15,000	ditto.
16	ditto	ditto	20,000	ditto.
15	ditto	ditto	25,000	ditto.

It is not considered necessary to extend this statement by entering upon the calculations as to the increased value given to lands, by being settled in the manner laid down, as there is no correct data within reach as to the average value of wild land, and that of land settled in the ratio established; but should these points be ascertained, the calculations would be very simple, although tedious from their number, were they pursued to each year mentioned in the table.

TABLE

Showing the annual increase of inhabitants in Upper Canada to the year 1847, and subsequent periods mentioned, until they shall reach 2,000,000 souls, at three and a half per cent. per annum, compoundiag the increase with the principal:—

Unassisted by Emigration.		Assisted annually by 5000 Emigrants.		Assisted annually by 10000 Emigrants.		Assisted annually by 15000 Emigrants.		Assisted annually by 20,000 Emigrants.		Assisted annually by 25,000 Emigarnts.	
Year.	Inhbts.	Year.	Inhbts.	Year.	Inhbts.	Year.	Inhbts.	Year.	Inhbts.	Year.	Inhbts.
1838...	400000 14000	1838...	400000 19000	1838...	400000 24000	1838...	400000 29000	1838...	400000 34000	1838...	400000 39000
1839...	414000 14490	1839...	419000 19665	1839...	424000 24840	1839...	429000 30015	1839...	434000 35190	1839...	439000 40365
1840...	428490 14997	1840...	438665 20353	1840...	448840 25708	1840...	459015 31065	1840...	469190 36421	1840...	479365 41777
1841...	443487 15522	1841...	459018 21065	1841...	474549 26609	1841...	490080 32152	1841...	505611 37696	1841...	521142 43239
1842...	459009 16065	1842...	480083 21802	1842...	501158 27540	1842...	522232 33278	1842...	543307 39015	1842...	564381 44753
1843...	475074 16627	1843...	501885 22565	1843...	528698 28504	1843...	555510 34442	1843...	582322 40381	1843...	609134 46319
1844...	491701 17209	1844...	524450 23355	1844...	557202 29502	1844...	589952 35648	1844...	622703 41794	1844...	655453 47940
1845...	508910 17811	1845...	547805 2417.	1845...	586704 30534	1845...	625600 36896	1845...	664497 43257	1845...	703393 49618
1846...	526721 18435	1846...	571978 25019	1846...	617238 31603	1846...	662496 38187	1846...	707754 44771	1846...	753011 51355
1847...	545156	1847...	596997	1847...	648841	1847...	700083	1847...	752525	1847...	804366
to 1856 10 ys	742987	to 1856 10ys	865483	to 1856 10ys	987984	to 1856 10ys	1110480	to 1856 10ys	1232980	to 1856 10ys	1355476
to 1865 10ys	1012609	to 1865 10ys	1231402	to 1865 10ys	1450200	to 1865 10ys	1668093	to 1865 19ys	1887789	to 1864 9 ys.	2011191
to 1874 10ys	1380078	to 1874 10ys	1730113	to 1873 9 ys.	2000150	to 1870 5 ys.	2062675	to 1867 3 ys.	2062946		
to 1883 10ys	1880901	to 1878 5 ys.	2006415								
to 1885 3 ys.	2014867										

If the number of inhabitants in any given year be multiplied by 32, it will show the number of acres settled: or, if it be divided by 20, it will give the number of statute miles settled.

The following table, given by Baron Ch. Dupin in his "Forces Productives et Commerciales de la France," showing the rate of increase in the population of the principal States of Europe, is highly curious, and may not be considered irrelevant to this statement:—

Annual increase upon each million of inhabitants, and period in which the population would double itself if the increase continued uniform:—

	Increase in 1,000,000 inhabitants.		Period of doubling.
Prussia,	27,027	....	26 years.
Britain,*	16,667	....	42 ,,
Netherlands,	12,372	....	56½ ,,
Two Sicilies,	11,111	....	63 ,,
Russia,	10,527	....	66 ,,
Austria,	10,114	....	69 ,,
France,	6,536	....	105 ,,

* This estimate is made upon the population of Europe in 1827, and as respects Great Britain is rather high; from 1811 to 1821 the increase was about 13,700 for Britain; for Ireland it might be about 20,000; and for both 15,800, and the period of doubling 45 years.

Von Malchus states the annual increase in all Europe to be two per cent., on about 215,000,000 inhabitants—the average issue of marriages four children.

NOTES.

(1) In 1832 the public domain in the new States and territories unsold, to which the Indian title had been extinguished, was estimated at . . . . 227,293,884 acres.
And the quantity in the same, to which the Indian title had not been extinguished, at . . . 113,577,869

340,871,753

The quantity of land beyond the limits of those States and territories, has been estimated . 750,000,000

1,090,871,753

—*Pitkin's Statistics of the United States*, 1835.

(2) The average value of lands per acre (including buildings), according to the valuations in 1814 and in 1815, ranged for each State from four dollars, the value of lands in Kentucky, to 39 dollars, the value of land in Rhode Island. The average value in 1814 of lands throughout the United States was about ten dollars per acre.—*Pitkin's Statistics.*

(3) According to the rate of increase upon the previous census in 1820, which gave an increase of 3,227,839 souls, the population might probably have been in 1834, 15,000,000 inhabitants.

(4) The population of Upper Canada, according to the census for

1811	was	77,000	1827	was	176,059
1824	...	151,000	1828	...	185,526
1826	...	163,702	1830	...	215,000

(5) Vide Bouchette.

(6) The number of acres under agricultural improvement in 1828 did not exceed 570,000 acres.—(Vide Bouchette.)

(7) T. Neilson, "Prize Essay."

(8) The population in 1838 being 400,000 inhabitants, would thus settle 12,800,000 acres.

The Grand Trunk Railway—The Victoria Bridge.

We are indebted to the kind and ready acknowledgement of a request made in the name of the Council of the Canadian Institute to Alexander Mackenzie Ross, Esq., Engineer in Chief of the Grand Trunk Railway, for the original copy of the engraving of the Victoria Bridge, which appears in the present number of the *Canadian Journal.*

This remarkable structure will be without a rival upon the Continent of America, and may, perhaps, be the most stupendous and imposing work of its class in the world. Mr. Ross describes the Victoria Bridge in the following comprehensive paragraph:—

"No better description of the design can be given, than that it consists of a wrought-iron box, 20 feet deep, 16 feet wide, and about 7000 feet in length; supported at intervals of about 260 feet, by towers of stone, and open at both ends to admit of the

trains passing through it, and made of sufficient strength to carry six times the heaviest load hitherto known to travel on railways in this or any other country."

In the accompanying plate of the Victoria Bridge, the centre arch is indicated by the steamer passing through it; the width between the towers is here 330 feet, or 110 yards, and the enormous tube which spans the gulf must be constructed so as "to sustain six times the heaviest load hitherto known to travel upon any railway in the world." Of course this is to be understood as applying to a train or part of a train 110 yards long—nevertheless involving a degree of strength and durability of which it is extremely difficult to form a just and accurate conception.

We hope to be able to furnish diagrams and descriptions of the details of this great Canadian work in future numbers of the *Journal*.

It will not be inappropriate, perhaps, to announce here the intention of the Council of the Institute to publish, from time to time, plans and views of the leading structures on the Grand Trunk, the Great Western, and other railways of Canada. Nor do we think that the time is far distant when—in continuing our illustrations of the great public works of this country—we may be enabled to delineate the details of the unrivalled Welland and St. Lawrence Canals, the Slides of the Ottawa, the Suspension Bridge and Rideau Locks at Bytown and other magnificent structures, which are scarcely known except by a misty reputation beyond the counties in which they are situated.

Subjoined is Mr. Stephenson's report on the Victoria Bridge to the Directors of the Grand Trunk Railway:—

24, Great George Street, Westminster,
2nd May, 1854.

Gentlemen,—Absence from England, and other unexpected circumstances, have prevented my sooner laying before you the results of my visit to Canada last autumn, for the purpose of conferring with your Engineer-in-Chief, Mr. Alexander Ross, respecting the Victoria Bridge across the River St. Lawrence, in the vicinity of Montreal.

The subject will naturally render itself into three parts, viz.:—

First,—The description of Bridge best adapted for the situation.

Second,—The selection of a proper site.

Third,—The necessity for such a structure.

Regarding the first point, I do not feel called upon to enter upon a discussion of the different opinions which have been expressed by engineers, both in England and America, as to the comparative merits of different classes of bridges, and more especially as between the suspension and tubular principles, when large spans become a matter of necessity. It is known to me that in one case in the United States a common suspension bridge has been applied to railway purposes, but from the information in my possession from a high engineering authority in that Country, the work alluded to can scarcely be looked upon as a permanent, substantial, and safe structure. Its flexibility, I was informed, was truly alarming, and although another structure of this kind is in process of construction near Niagara, in which great skill has been shewn in designing means for neutralising this tendency to flexibility, I am of opinion that no system of trussing applicable to a platform suspended from chains will prove either durable or efficient, unless it be carried to such an extent as to approach in dimensions a tube fit itself for the passage of railway trains through it. Such bridge may doubtless be sucessfully, and perhaps with propriety, adopted in some situations, but I am convinced that even in such situations, while they will in the first cost fall little short of wrought iron tubes, they will be more expensive to maintain, and far inferior in efficiency and safety.

I cannot hesitate, therefore, to recommend the adoption of a Tubular Bridge, similar in all essential particulars to that of the Britannia over the Menai Straits in this Country; and it must be observed, that, the essential features being the same, although the length much exceeds that of the work alluded to, none of the formidable difficulties which surrounds its erection will be involved in the present instance. In the Britannia, the two larger openings were each 460 feet, whereas in the proposed Victoria there is only one large opening of 330 feet, all the rest being 240 feet. In the construction of the latter, there is also every facility for the erection of scaffolding which will admit of the tubes being constructed in their permanent position, thus avoiding both the precarious and expensive process of floating, and afterwards lifting the tubes to the final level by hydraulic pressure.

In speaking of the facilities, it is a most agreeable and satisfactory duty to put on record that the Government Engineering Department has, throughout the consideration of this important question, exhibited the most friendly spirit, and done everything in its power to remove several onerous conditions which were at one time spoken of as necessary, before official sanction would be given for the construction of the Work.

On my arrival in Canada, I found that Mr. A. M. Ross had collected so much information bearing on the subject of the site of the Bridge, that my task was comparitavely an easy one.

Amongst the inhabitants of Montreal, I found two opinions existing on this point—somewhat conflicting: the one side maintaining that the River should be crossed immediately on the lower side of the city, where the principal channel is much narrower than elsewhere, and where also the Island of St. Helens would shorten the length of the Bridge; the other seeming to be in favour of crossing a little below Nun's Island.

Sections of the bed of the River at both points had been prepared, and a careful study of these left no doubt on my mind that the latter was decidedly the one to be adopted.

In addition, however, to the simple question of the best site for the construction of a bridge across the St. Lawrence, my attention was specially called to the feasibility of erecting and maintaining such a structure during the breaking up of the ice in spring, when results take place which appear to every observer indicative of forces almost irresistible, and, therefore, such as would be likely to destroy any piers built for the support of a bridge. I have not myself had the advantage of witnessing these remarkable phenomena, but have endeavoured to realise them in my mind as far as practicable by conversation with those to whom they are familiar, and, in addition to this, I have read and studied with great pleasure an admirable and most graphic description by Mr. Logan of the whole of the varied conditions of the river, from the commencement of the formation of ice to its breaking up and clearing away in spring. To this memoir I am much indebted for a clear comprehension of the formidable tumult that takes place at different times amongst the huge masses of ice on the surface of the river, and which must strike the eye as if irresistible forces were in operation, or such as, at all events, would put all calculations at defiance.

This is no doubt the first impression on the mind of the observer; but more mature reflection on the subject soon points out the source from which all the forces displayed must originate.

The origin of these powers is simply the gravity of the mass occupying the surface of the water with a given declivity up to a point where the river is again clear of ice, which in this case, is at the Lachine Falls. This is unquestionably the maximum amount of force that can come into play; but its effect is evidently greatly reduced—partly by the ice attaching itself to the shores, and partly by its grounding upon the bed of the river. Such modifications of the forces are clearly beyond the reach of calculation, as no correct date can be obtained for their estimation; but if we proceed by omitting all consideration of those circumstances which tend to reduce the greatest force that can be exerted, a sufficiently safe result is arrived at.

In thus treating the subject of the forces that may be occasionally applied to the piers of the proposed bridge, I am fully alive to many other circumstances which may occasionally combine in such a manner as apparently to produce severe and extraordinary pressure at points on the mass of ice or upon the shore, and, consequently, upon the individual piers of a bridge. Many inquiries were made respecting this particular view, but no facts were elicited indicative of forces existing at all approaching to that which I have regarded as the source and the maximum of the pressure that can at any time come into operation affecting the bridge.

I do not think it necessary to go into detail respecting the precise form and construction of the piers, and shall merely state, that in forming the design, care has been taken to bear in mind the expedients which have hitherto been used and found successful in protecting bridges exposed to the severe tests of a Canadian winter, and the breaking of the ice of frozen rivers.

I now come to the last point, viz., the necessity of this large and costly bridge.

Before entering on the expenditure of £1,400,000 upon one work in any system of Railways, it is of course necessary to consider the bearing which it has upon the entire undertaking if carried out, and also the effect which its postponement is likely to produce.

These questions appear to me to be very simple, and free from any difficulty.

An extensive series of Railways in Canada, on the north side of the St. Lawrence, is developing itself rapidly; part of it is already in operation, a large portion fast progressing, and other lines in contemplation, the commencement of which must speedily take place.

The commerce of this extensive and productive country has scarcely any outlet at present, but through the St. Lawrence, which is sealed up during six months of the year, and therefore very imperfectly answers the purposes of a great commercial thoroughfare.

Experience, both in this and other countries where railways have come into rivalry with the best navigable rivers, has demonstrated, beyond the possibility of question, that this new description of locomotion is capable of superseding water carriage wherever economy and despatch are required; and even where the latter is of little importance, the capabilities of a railway, properly managed, may still be made available, simply for economy.

The great object, however, of the Canadian system of railways is not to compete with the River St. Lawrence which will continue toa ccommodate a certain portion of the traffic of the country, but to bring those rich provinces into direct and easy connection with all the ports on the East Coast of the Atlantic, from Halifax to Boston, and even New York,—and consequently through these ports, nearer to Europe.

If the line of Railway communication be permitted to remain severed by the St. Lawrence, it is obvious that the benefits which the system is calculated to confer upon Canada must remain in a great extent nugatory, and of a local character.

The Province will be comparatively insulated, and cut off from that coast to which her commerce naturally tends; the traffic from the West must either continue to adopt the water communication, or, what is more probable —nay, I should say, *certain*—it would cross into the United States, by those lines nearly completed to Buffalo, crossing the river near Niagara.

No one who has visited the country, and made himself acquainted only partially with the tendencies of the trade which is growing up on all sides in Upper Canada, can fail to perceive that if vigorous steps be taken to render railway communication with the Eastern Coast through Lower Canada uninterrupted, the whole of the produce of Upper Canada will find its way to the Coast through other channels; and the system of lines now comprised in your undertaking will be deprived of that traffic upon which you have very reasonably calculated.

In short, I cannot conceive anything so fatal to the satisfactory development of your Railway as the postponement of the bridge across the river at Montreal. The line cannot, in my opinion, fulfil its object of being the high road for Canadian produce, until this work is completed; and looking at the enormous extent of rich and prosperous country which your system intersects, and at the amount of capital which has been already, or is in the progress or prospect of being expended, there is in my mind no room for question as to the expediency—indeed, the absolute necessity of the completion of this bridge, upon which, I am persuaded, the successful issue of your great undertaking mainly depends.

I am, Gentlemen, yours faithfully,

ROBERT STEPHENSON.

To the Directors of the Grand Trunk Railway of Canada.

Canadian Institute.

At a general meeting of the Institute, held on the 6th of May, 1854, the following resolution was adopted:—

"That the amalgamation of the Toronto Athenæum with the Canadian Institute be agreed to, and be carried into effect according to the conditions set forth in the communication from the Council, which has just been read."

The Communication from the Council consisted of a recommendation to adopt and act upon the Report of the Special Committees of the Canadian Institute and Toronto Athenæum, appointed to confer on the subject of the union of those Institutions.

The Report alluded to, together with the resolution of the Council, are given in full on page 195 of this *Journal*, and need not, therefore, be repeated here.

At a meeting of the Council of the Canadian Institute, held on Saturday, June 3d, it was resolved—

"That the thanks of the Council be transmitted to Alexander Mackenzie Ross, Esq., Chief Engineer of the Grand Trunk Railway, for his kindness in furnishing the original copy of the plate of the Victoria Bridge, which appears in the June number of the *Canadian Journal*."

A member of the Canadian Institute, distinguished as much by an ardent love for natural science as for the remarkable liberality with which he encourages and promotes its study, has signified his intention of presenting the Institute with a very commodious piece of land in the city of Toronto for the construction of a building, subject to the condition that, either through the munificence of the Provincial Government or by means of private liberality, the necessary funds for the erection of a suitable building be ensured. We hope to enjoy the privilege of being more explicit and definite in the July number.

Coal in Canada.

We have observed with much regret that the question of the existence of coal in Canada West is again revived. The dark-coloured bituminous shales of the Utica slate have been once more mistaken for the "black diamond." The shales alluded to in a letter which has lately acquired a very wide circulation throughout this country by means of the provincial press, are many thousand feet below the true coal measures, and no wilder speculations could be indulged in than attempts at finding coal where those black shales appear. Sensible persons will soon be perfectly satisfied on this matter by the speedy publication in this *Journal*, of a paper "On the Physical Structure of Western Canada," by W. E. Logan, F.R.S., and G.S. Provincial Geologist. The delays which have arisen in the publication of that distinguished geologist's paper, have proceeded from the great difficulty which has been experienced in obtaining a correct copperplate engraving of a geological map of Western Canada. We hope, however, to be able to enrich the pages of the first number of the third volume of the *Canadian Journal*, to be published in August next, with an accurate plate of Mr. Logan's most valuable and instructive map.

The Quebec Meteorological Table for *April* was received at the office of the Canadian Journal, on Tuesday, the 13th *June*. This unusual delay will probably form an excuse for its non-appearance in the present number. As yet, we are quite unable to conjecture with whom the fault lies. We hope that it will be found side by side with its May brother in our next issue.

SANG'S PLANIMETER,

OR SELF ACTING CALCULATOR OF SURFACE.

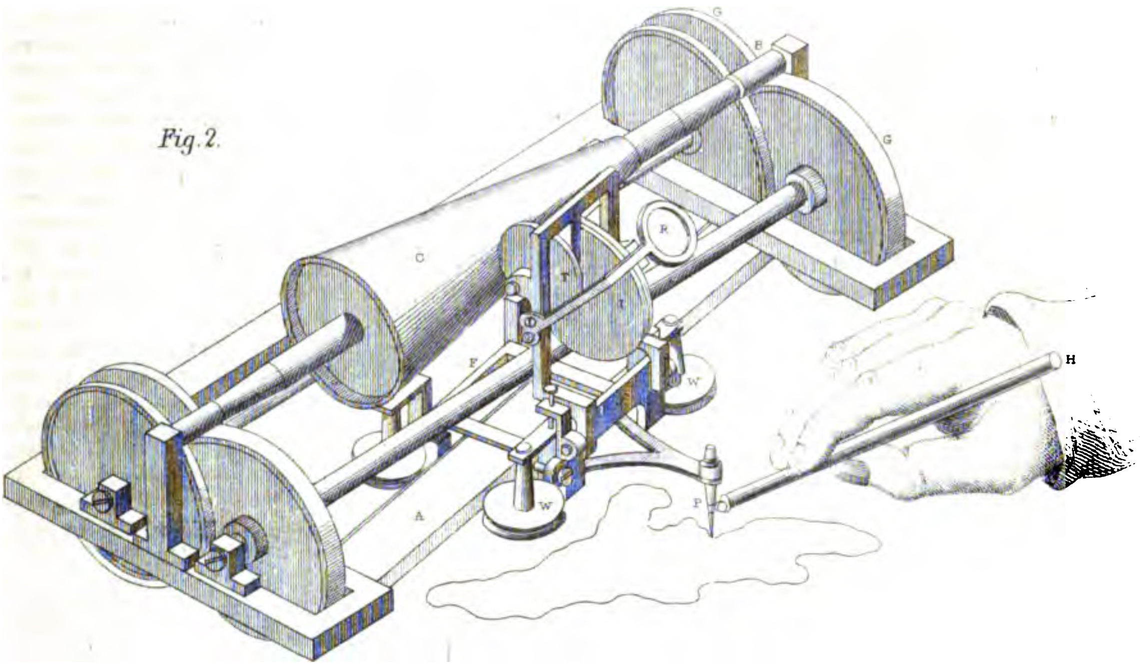


Fig. 2.

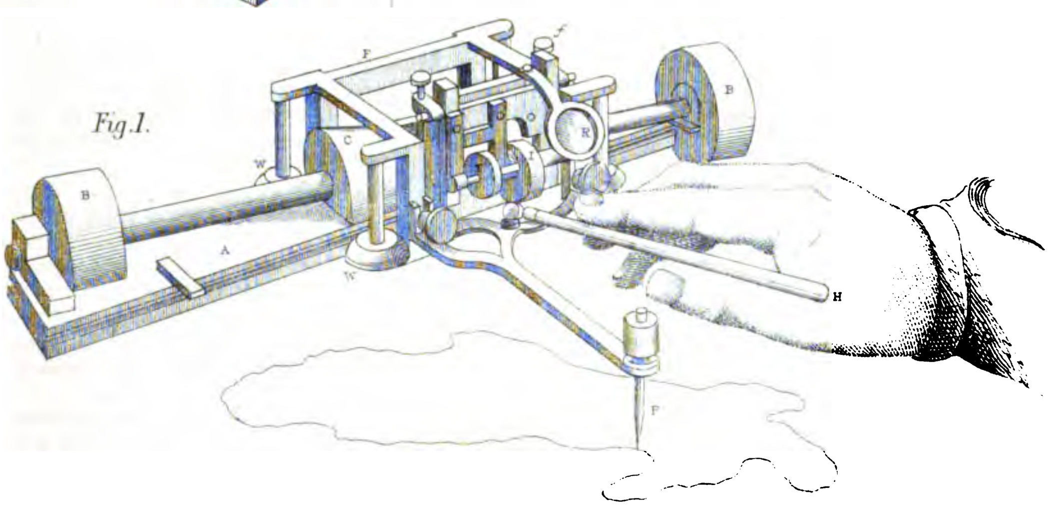


Fig. 1.

The Canadian Journal.

TORONTO, JULY, 1854.

On the Periodical Rise and Fall of the Lakes.

By MAJOR LACHLAN, *Montreal.*

Few countries can boast of objects of more imposing natural grandeur, or deeper philosophical interest, than are presented in Canada—in the vast extent and other striking peculiarities of its magnificent inland *fresh water* seas, and their noble connecting rivers and unrivalled cataracts, coupled with the singularly anomalous nature of its climate and seasons, compared with European countries in the same parallels of latitude; and an additional geographical interest may be considered as attaching to it, in the magnetic meridian passing through it—the line of "No variation" curving through part of its mediterranean waters.*

The investigation of the causes and effects of these great physical phenomena might well engage the attention of a whole life of patient observation and study; and such, doubtless, will at no distant day, be the case; but in the present state of things, in so young a country, all that can be expected is the occasional contribution of the unpretending philosophical *gleaner;* and, as such, I now venture to lay before the Canadian Institute the following desultory observations on the periodical rise and fall of our great Lakes, in the hope of strengthening the arguments adduced by me in the Paper which I had lately the honour of submitting to it, in advocacy of the establishment of a system of simultaneous meteorological and tidal observations throughout British America—as not only a great philosophical desideratum, but also likely to prove of substantial service to the country, were it only to make us better acquainted with the great benefits derived and derivable from the climatic influence of our mighty inland waters.‡

In the introduction to my former paper, I was led to remark that it is now seventeen years since my attention was first attracted to these interesting philosophical subjects, by remarking the great difference in the newspaper reports of the temperature, direction of the winds, and state of the weather in different parts of the Province at the same time, as compared with each other, and by having at my residence on the banks of Lake Erie been for seven years in the habit of noticing the constant extraordinary fluctuations in the level of that noble Lake; at times consisting only of slight irregularly recurring oscillations; at others, showing a sudden change of level, apparently caused by the temporary impulse of passing storms; at others, evincing a longer continued state of elevation or depression, in evident accordance with the more enduring influence of winds blowing from the same quarter for days together; and at others, and more especially and unaccountably, of a longer maintained rise of several feet above the usual level, sometimes lasting for a whole season, or even more, as was the case during the memorable years, 1838-39—regarded at the time by some of my neighbours as the traditional seven years' flood.

Being much struck with these singular phenomena, and yet not being sufficiently at leisure, as well as feeling myself otherwise disqualified for attempting a scientific investigation of their causes, I nevertheless naturally felt a strong desire to ascertain what had been, or might, from time to time be written on the subject by more able philosophical observers; and I accordingly made a practice of taking notes from all such published works, and other sources of information, as referred to them, as they happened to fall in my way, until I had, in the course of years, accumulated a mass of miscellaneous memoranda—not to call it testimony—on the subject, of so conflicting a character as frequently rather to add to the perplexity than promote the elucidation of the object in view; and the consequence was, that, after vainly attempting to classify and reconcile the information therein contained, regarding the rise and fall of the Lakes generally, and comparing it with my own passing observations and enquiries respecting Lake Erie in particular, I came to the conclusion that there was still much room for further investigation, as all the Lakes did not appear to be always governed by simultaneous influences;* and, therefore, that the only chance of arriving at a correct knowledge of the state of the whole matter would be the adoption of some such course of long-continued meteorological and tidal observations throughout the country, as that which I ventured to propose in my last paper.

Having in that communication enlarged principally on the value of a wide-spread series of simultaneous meteorological observations, as the more important branch of the great object in contemplation, I propose to confine myself, on the present occasion, to the no less interesting, though minor, part of the undertaking—aiming at the institution of a simultaneous record of the daily variations in the level of the great Lakes, with the view of throwing light on, and, if possible, deciding the three following doubtful points: 1st, How far there is any foundation for the traditional report, that there is a septennial rise and fall in the waters of the Lakes, and if so, to what height; and whether such phenomenon takes place in all the Lakes simultaneously or otherwise. 2d, The amount of the better known annual variations in the level of the different Lakes; and how far these changes occur in each at the same time; and whether they are solely due to the annual amount of the rain and snow in the surrounding country, compared with that of the evaporation during the summer months, or to any other cause therewith combined. And 3d, How far the daily or other more frequent oscillations, or irregular tides, observable in the different Lakes, are general, and arise from the temporary force and direction of winds passing over their surface, or are peculiar only to certain localities; and whether they are in any sensible degree influenced by atmospheric pressure, or lunar attraction, or otherwise. All which, it is hoped, would in the course of time be satisfactorily decided, by a daily record of the actual level of the Lakes, combined with that of the prevailing winds and weather, at a

* To do justice to the subject treated of in this Paper, a good map of British America should be at hand to be referred to, and, above all others, that graphic "Map of the Valley of the St. Lawrence," constructed by T. C. Keefer, Esq., in which the striking connection of the whole system of Lakes is so well pourtrayed.

† As a remarkable instance of the *tempering* influence of the proximity of the Lakes, it may here be mentioned, that in the immediate vicinity of Cleveland, the temperature during 10 years has in no instance fallen below Zero, while at Colombo, Lunicella, and Cincinnati, from 120 to 150 miles farther south, it has frequently sunk to 5 deg. and 10 deg. below it; and that in Northern Ohio, generally, the tender vegetation is usually cut down within five days of the 25th October, whereas the Lake shore remains untouched for two weeks later; and during the winter, when deep snow falls elsewhere, there is comparatively little near the Lake.—American Journal of Science, 2d Series, vol. 13, pp. 215 to 219.

‡ This will be found patiently illustrated in a tabular view of the Rise and Fall of Lake Erie, incorporated in this paper.

fixed number of stations, at hours simultaneous with the other meteorological observations.

Taking it, at all events, for granted that such will be the case, I proceed, as an indispensable preliminary step, to take a discursive view of the yet debateable state of the question, as brought home to my mind by a comparison of the casual observations made by myself on Lake Erie, compared with the recorded opinions expressed by others, possessing either greater ability, or more leisure and better opportunities, for prosecuting such an enquiry,—as far as the very miscellaneous and disjointed memoranda accumulated by me will enable me to do so.

In accordance with this intention I may, in the first place, remark, that though the phenomena connected with the various periodical fluctuations in the level of the Lakes appear to have attracted the notice of philosophic travellers near two centuries ago, they remained altogether uninvestigated till very lately. The minor tides or oscillations were first alluded to by Fra. Marquette, the Jesuit, in 1673, and more particularly by the Baron La Hontan in 1689: and they were afterwards further noticed by Charlevois in 1721, and also by the British travellers, Mr. Carver in 1766, and Mr. Weld in 1796; but it was not till twenty years afterwards that the whole subject began to engage the particular attention of men of science in America, and especially of the talented individuals engaged in the Geological Surveys of the States of New York, Ohio, and Michigan—among whom I find them successively noticed by Colonel Whiting in 1819 and 1829, Mr. Schoolcraft in 1820, General Dearborn in 1826, and Governor Cass in 1828; and more particularly by Professors Hall and Mather, Colonel Whittlesley, Dr. Houghton, Mr. Higgins, and others, in their valuable official reports, from 1838 to 1842; as well as by various observant British officers and travellers, such as Captains Bayfield and Bonnycastle, and Messrs McTaggart, Macgregor, and others, the purport of all of whose observations will be found more or less glanced at in the sequel:—and yet, strange to say, these singular phenomena still remain involved in mystery!

It so happens that the observations of all the early writers on this interesting subject were confined to Lakes Superior, Michigan, and Erie, and were directed more to the daily fluctuations or tides remarked at particular places, than to the actual existence of the traditionary great septennial rise and fall of the waters of the whole Lakes. Thus, for instance, Baron La Hontan, on reaching Green Bay, at the northern extremity of Lake Michigan, at its conjunction with Lake Huron, remarks that where the Fox river is discharged into that Bay, he observed the waters of the the Lake swell three feet high in the course of twenty-four hours, and decrease as much in the same length of time. And he also noticed a contrariety and conflict of currents in the narrow strait which connects Lakes Huron and Michigan, which were so strong that they sometimes sucked in the fishing nets, although two or three leagues off. In some seasons it also happens that the current runs three days eastwards, two days westwards, and one day to the south, and four to the northwards, sometimes more and sometimes less.

Charlevois also noticed similar appearances; and supposes Lakes Huron and Michigan to be alternately discharged into each other through the Straits of Michillimackinac; and mentions the fact that in passing that Strait his canoe was carried by the current against a head wind.

But it was not till 50 years afterwards that we were indebted to that intelligent British traveller, Mr. Carver, for any great additional light on this mysterious subject, as well as for other particulars regarding the then unknown region of Lake Superior, from information acquired on the spot. But as his remarks are alluded to by a subsequent equally respectable and observant English writer, Mr. Weld, who visited Canada in 1796, we are content to refer to the interesting volume of the latter for the following (much condensed) appropriate observations.*

"It is confidently asserted, not only by the Indians, but also by great numbers of the white people who live on the shores of Lake Ontario, that the waters of this Lake rise and fall alternately every seventh year. Others, on the contrary, deny that such a fluctuation does take place; and, indeed, it differs so materially from any that have been observed in large bodies of water in other parts of the globe, that I am tempted to believe it is merely an imaginary change. Nevertheless, when it is considered, that, according to the belief of the oldest inhabitants of the country, such a periodical ebbing and flowing takes place, and that it has never been clearly proved to the contrary, we are bound to suspend our opinions on the subject. For instance: a gentleman who resides close upon the borders of the Lake, not far from Kingston, and had leisure to attend to such subjects, told me that he had observed the state of the Lake for nearly fourteen years, and that he was of opinion that the waters did not ebb and flow periodically; yet he acknowledged the very remarkable fact that several of the oldest white inhabitants in his neighbourhood declared, previous to the late rising of the Lake, that the year 1795 would be the high year; and that in the summer of that year the Lake actually did rise to a very uncommon height. He said, however, that he had reason to think that the rise on this occasion was wholly owing to fortuitous circumstances, and not to any regular established law of nature; and that its being greater than usual was more imaginary than real; and he formed this opinion from the circumstance that when the Lake had risen to its unusual height in 1795, he had questioned some of the oldest people as to the comparative height of the water on this and former occasions, when they affirmed that they had seen them equally high before." Now, a grove of trees which immediately adjoined this gentleman's garden, of at least thirty years' growth, was entirely destroyed this year by the waters that flowed amongst them; and if, therefore, the Lake had ever risen so high before, this grove would have been then destroyed; a circumstance militating stongly against the evidence as to the height of the waters, but which only proved that they had risen on this occasion higher than they had done for thirty years' preceding, and *not* that they had not during that term risen *periodically* above their usual level.*

* I take the opportunity of here remarking that I might easily have imparted a seeming greater degree of originality to this paper by continuing to make only occasional reference to parts of information derived from different writers, and connecting them with a few second-hand observations in my own language; but feeling myself already dissatisfied on that head, and being desirous of exhibiting the whole evidence on the question, independent of any opinion of my own, I have adopted a more equitable course, in, as much as possible, allowing my authorities to speak for themselves, in their own language. I may at the same time add, that, in perusing the following and other hurriedly copied extracts and memoranda, accumulated at uncertain intervals during a course of more than fifteen years, and frequently at times when opportunities of access to books were "like angels' visits, few and far between," it must be borne in mind that they were made without any view to publication, and simply for the purpose of furnishing the means of hereafter comparing the observations of different writers on an important philosophical question, in which I had long taken a deep interest; and that they will, therefore, perhaps often be found neither altogether verbatim nor regularly connected, and perhaps even betraying not

What Mr. Carver relates concerning this subject rather tends to confirm the opinion that the waters of the Lake do rise periodically. "I had like (he says) to have omitted a very extraordinary circumstance relative to these Straits (of Michillimackinac, between Lakes Michigan and Huron). According to observations made by the French, whilst they were in possession of the fort there, although there is no diurnal flood or ebb to be perceived in these waters, yet from an exact attention to their state a periodical alteration has been discovered. It was observed that they arose by gradual but almost imperceptible degrees till they had reached the height of three feet. This was accomplished in seven and a half years; and in thé same space of time they as gently decreased, till they had reached their former situation. So that in fifteen years they had completed their inexplicable revolution. At the time I was there, the truth of these observations could not be confirmed by the English, as they had then been only a few years in possession of the fort, but they all agreed that some alteration in the limits of the Straits was apparent." "It is to be lamented (judiciously added Mr. Weld) that succeeding years have not thrown more light on this subject. . . . A long series of observations are necessary to determine positively whether the waters of the Lakes do or do not rise and fall periodically. It is well known, for instance, that in wet seasons they rise much above the ordinary level, and that in very dry seasons they sink considerably below it; a close attention, therefore, ought to be paid to the quantity of rain that falls, and to evaporation; and it ought to be ascertained in what degree the height of the Lake is altered thereby, otherwise, if it happens to be higher or lower than usual on the seventh year, it would be impossible to say with accuracy whether it were owing to the state of the weather, or to certain laws of nature, that we are as yet unacquainted with. At the same time great attention ought to be paid to the state of the winds, as well in respect to their direction as to their velocity—for the height of the water in all the Lakes is materially affected thereby. Moreover, these observations ought not to be made at one place only, but at different places at the same time. . . .

"It is also believed by many persons that the waters of Lake Ontario not only rise and fall periodically every seventh year, but that they are likewise influenced by a tide which ebbs and flows frequently in the course of twenty-four hours—as, for instance, in the Bay of Quinté, where it has been observed to rise fourteen inches every four hours. But there can be no doubt that this must be caused by the wind—no such regular fluctuation being observed at Kingston, and this Bay being a long crooked inlet, that grows narrower at the upper end; and therefore not only a change of wind up and down would make a difference at the upper extremity, but the waters, being concentrated there, would be seen to rise or fall, if impelled even in the same direction, whether up or down, more or less forcibly at one part of the day than another. . . An appearance like a tide must therefore be seen almost constantly at the head of this Bay, whenever there is a breeze. I could not learn that the fluctuation had ever been observed during a perfect calm; were the waters, however, influenced by a regular tide, during a calm, that would be most readily seen."

a few verbal errors; but whatever their defects may be, compared with the originals, the reader may be assured that there was no intention to alter or distort the meaning or merits of the author, and that they may therefore be considered as a faithful epitome of more extended observations.

* The destruction of these trees would depend more on the length of time they were inundated, than on the mere fact of their having been temporarily flooded.—R. L.

Reserving any comments on the foregoing pertinent extracts for a future page, I proceed to remark, that such continued to be the unsatisfactory amount of information on this interesting debateable philosophical question, till about 1819, when Capt. (afterwards Col.) Whiting, of the American Army, at length recurring to the exciting subject, made, at the request of Governor Cass, a series of regular observations upon these oceanic appearances, during seven or eight days, in the month of June, serving to show that at that remarkable inlet, Green Bay, there is a daily rise and fall, but that it is irregular as to the precise period of flux and reflux, and also as to the height which it attains;* and yet such was the variety of opinion among local residents on the fact, that he is compelled to state, in the course of his remarks, that being led to suppose that the winter would be the most favourable time for making such observations, when the superincumbent ice would nearly destroy the influence of the winds, and show the unassisted operation of the tide, he made enquiries as to its appearance during that season, when one gentleman informed him that *no* tide was then discernible, while another, equally intelligent, assured him that it was *very apparent*, and that there was a regular elevation and depression of the ice!

From all which conflicting circumstances (as judiciously observed by (I think) Mr. Schoolcraft in the same article) there was reason to conclude that a well-conducted series of experiments would prove that there are *no* regular tides in the Lakes; at least, that they do not ebb and flow twice in twenty-four hours, like those of the ocean; that the oscillating motion of the waters is therefore not attributable to planetary attraction; and that it is very variable as to the periods of its flux and reflux, depending upon the levels of the several Lakes, their length, depth, direction, and conformation, upon the prevalent winds and temperature, and upon other extraneous causes, which are in some measure variable in their nature, and unsteady in their operation.

Colonel Whiting further remarks in another interesting article on the supposed tides and periodical rise and fall of the North American Lakes,† in which is given a table of observations kept at Green Bay, in six weeks, July and August, 1828, that an examination of that record would satisfy any one that planetary influence had little or nothing to do with the changes of elevation in the waters there noted; and that it was as certain that the fluctuations in some places appear to be independent of atmospheric as of lunar control; as, by consulting that table, there would probably not be found one instance where the time of high water tallies with the moon's southing, admitting the usual retardation. And further, that it would also be seen that the changes of elevation were independent of the course of the wind; for that the fluctuation continues, notwithstanding the winds remaining the same. He, therefore, came to the conclusion that, reasoning from our knowledge of the great inland waters of the other hemisphere, we should take it for granted that the North American Lakes have no sensible tides; the Caspian, Black, and Baltic Seas being said to have none worthy of observation, and even the Mediterranean being indebted to the sharp-sightedness of modern times for the knowledge of there being such a phenomenon on her wide-spread bosom.‡ Col. Whiting, however subsequently remarks, writing in 1830, with regard to what General Dearborn terms "the periodical increase of the whole volume of waters in the American Lakes," that it is the popular tradition on these Lakes that there has been a rise and fall once

† See American Journal of Science, Vol. 16, pp. 90 and 91.

‡ See American Journal of Science, Vol. 20, pp. 205 to 219.

§ See close of this article.—R. L.

in every fourteen years, or that its recurrence has been sufficiently precise to authorise the belief in its regularity; but that the New York Canal Commissioners state the intervals to be once in about eleven years; and that no actual observations appeared to have been made on the progress of the elevation, as to whether there were any preceding seasons of a character to produce it; and, therefore, after noticing various well-known periods at which remarkable elevations and depressions took place, such as in 1800, 1815, 1820, 1828, and 1830, by way of proof of the periodical return of that phenomenon being regular or otherwise, he was obliged to come to the conclusion that, as far as *facts* go, they are certainly in favour of the popular theory, but that it rests on these facts alone, and is in many other points of view improbable and absurd; and that we are therefore constrained to suppose, though destitute of the light of actual observation, that the fluctuations observed must have been caused by unusually abundant rains and snow, and that this abundance had been in fortuitous coincidence with certain *cycles* of time; for, improbable as this may be, it is less so than that nature should have departed from her ordinary course.*

Having, in a previous page, quoted largely from Mr. Weld, I now proceed to notice the judicious remarks on the rise and fall of the Lakes by another intelligent British observer, Mr. McTaggart, who, writing in 1828, sets out by at once *affirming* that "there are no tides in any of the Lakes—none, at least, from the moon's influence: but that the floods of spring generally raise them from three to four feet. It is said that Lake Ontario rises once in every seven years higher than usual by two feet. The people ascribe this to some supernatural cause. In the spring of 1827 it had one of these periodical tides, rising nearly three feet higher than it had done the previous year, and keeping high the whole summer. Being in the neighbourhood (observes Mr. McT.) I paid the utmost attention to the phenomenon, and found that there fell during that summer much more rain than had fallen for many years before; and that there was little sunshine throughout the season; and I, consequently, concluded that the exhalations from the Lake were not so copious. There was another circumstance that puzzled me. Lake Ontario, and indeed, all the Lakes were up to their very highest surface marks, *but the rivers flowing out of them were not.* Those surface marks were very obvious on the rocky shores of the Lakes, drawn like so many chalk lines by Nature herself.

"Rivers do not rise exactly from the same cause as Lakes. If in spring the snow melts off the country on a sudden, and the frozen swamps break up and disembogue their contents, then the rivers will rise to their utmost height as water pours into them on all sides; but when the sun has effected this, they begin to fall. Lakes swell, it is true, from the same cause, but not with the same comparative haste; their surface being of great extent, the floods can only spread over them by slow degrees; and if the sky keep cloudy and the weather moist, so that little evaporation goes on, the surface of the Lake will continue to swell, while that of the river will fall—as the country on either side is drained—nothing tending to keep up its flood but the mere discharge from the Lake. Rivers and Lakes are never at their utmost pitch of flood at the same time; neither are they ever at the lowest ebb at the same time; for when the floods of a river have subsided to a certain extent, the intense heat of the summer sun, setting upon the shelving sides of the rocky channels, and even upon the bed of the river itself, tends greatly to promote the absorption of the waters, whereas in the deep wide Lake this action cannot take place.

"The unusual rise of the waters of the Lakes in some seasons, which some observers state to be seven feet above the common level, seems to be only rationally accounted for by the absence of evaporation, and greater quantities of rain than generally prevail. Once in every seven years it is said to rise thus; but 7, like 3, is a number open to superstition,† not to be always relied on, and it would not be surprising if this flow were to happen once in six, or even in ten years. It will yet, likely, be discovered that when Lake Erie has its brim flood, the others have theirs also during the same season; and when powerful suns are excluded from drinking them up, by the intervention of drizzling clouds, and this exclusion extending over an immense surface, we shall cease to marvel at these wonderful septennial floods. It has also been remarked that the winters after these seasons have had little snow; but *meteorology on this score remains to be further prosecuted, ere the theory dare be advanced, that it is from the moisture absorbed in circumjacent regions* during summer that the snows of winter are supplied."

Passing from the borders of Lake Ontario to the regions of Lake Superior, I am next enabled to refer to some equally peremptory observations on the same subject, made by that eminent British hydrographer and geologist, Capt. Bayfield, on the spot, in the course of 1825-26; from whose valuable and interesting paper on the geology of the latter Lake I extract the following particulars:‡

"There is no regularly periodical rising or falling of the Lakes, as has been asserted, whether it be from the influence of the moon, or any other. They rise and fall from accidental causes; such as a very severe winter without the usual thaws. The springs are locked up all winter, and the whole accumulated snow remains until the spring, when the weather, becoming suddenly warm, dissolves it at once. Hence it will generally be found that after a very severe winter, the waters of the Lakes will be much higher than at other times. Heavy gales also raise the water in the upper parts of the Lakes, and also cause *currents* in various directions. The rise, however, in Lakes Superior and Huron, from this or any other cause, never exceeds a few feet. . . Whether a gradual diminution of the waters of Lake Superior is now going on, is a point on which no one is qualified to give an opinion; for no observations have been made or recorded to ascertain the interesting fact. Any diminution must be always imperceptibly gradual, and would require constant, accurate, and regularly recorded observations during a great number of years to render this indisputable. The streams which discharge into Lake Superior amount to several hundreds in number, and the quantity of water supplied by them is many times greater than that discharged at the falls of St. Mary, the only outlet. There is, however, no reason to imagine from this that the quantity of water increases; for it is absolutely necessary that there should be a supply very far exceeding the discharge, to replace the immense expenditure arising from the evaporation from so extensive a surface."

Adhering to my intention of reserving for the present any comments on the above, as of other quotations, I now revert to

* See American Journal of Science, Vol. 20, pp. 218, 219.

† It was stated by Professor Johnston, in his address at the New York Agricultural Society meeting at Syracuse, as a fact, that Holland is exposed, on the average of the last thirteen centuries, to one great sea or river flood, every seven years.—R. L.

‡ See Transactions of the Lit. and Hist. of Quebec, Vol. I., pp. 1 to 43.

the next American writer on this important subject, namely, General Dearborn, who, in the 16th volume of the American Journal of Science, already referred to, observes that "it is not sufficiently certain that tides may not be produced in the great chain of Lakes, in the same manner as they are in the ocean;" and in proof thereof quotes an elaborate theory of the distinguished Dr. Young (illustrated by three diagrams) which had at that time been sanctioned by the scientific for more than twenty years, not only presuming the possible existence of such tides, but furnishing the means of demonstrating that such is the fact in deep and broad lakes, and even going so far as, where the area and depth of a lake is known, to give a theorem by which the maximum rise and fall of the waters and the time of its oscillation, or in which a tide wave might pass over it, can be ascertained.* But the General at the same time admits, with regard to "the periodical increase and diminution of the whole volume of water in the Lakes," that he is in possession of no definite facts, save what was contained in a letter from Captain Dearborn, stating, that whilst stationed at the Sault Ste. Marie, on Lake Superior, he had himself observed for three successive days an ebb and flow of about one-and-a-half feet, in the course of about two-and-a-half hours each; but that he attributed it to the winds; and that he supposed that the rise and fall which takes place during periods of from three to seven years, to be possibly the effect of increased depth of water in the Lake, caused by an unusual amount of snow on its borders and tributary streams, or an uncommon rainy season; and that it even appeared from an extract from the *New York Advertiser*, that a gentleman just then (1828) returned from a tour to the West, had informed the editor that the waters of Lakes Ontario and Erie were then nearly a foot higher, while those of Lake Superior were considerably lower than ever known. The General was therefore led to suggest that, to obtain full and exact data as to the rise and fall of the different Lakes, tide-guages should be placed at a number of points on the shore of each, both in their narrowest and broadest dimensions, and the changes carefully observed for a whole year, or at least for several months, and accurate tables kept of the times and extent of each flux and reflux, in which the position, as respects the meridian and the phases of the moon, and also the course of the winds should be noted;—a plan which, it will be perceived, is very similar to that proposed by myself in my late paper on the establishment of simultaneous meteorological observations.

Such continued to be the state of the question, till the institution, by the American States, of those great patriotic works, the Geological Surveys of New York, Ohio, and Michigan, when the subject being taken up by the talented individuals employed in that duty, as far as their other immediate avocations would permit, with that spirit which ever distinguishes the lovers of science, I was enabled to glean many interesting additional particulars from their official reports, though, unfortunately, none sufficiently conclusive to solve the great philosophical problem so long under discussion. Among these I, of course, rank first the eminent American geologist, Professor Hall, from whose elaborate work, put forth under the enlightened auspices of the State of New York, I extract the following valuable remarks on the elevation and depression of the great Lakes:†

"The fluctuating level of the waters of these Lakes has long excited attention; and many speculations have been hazarded to account for the phenomenon. The somewhat general belief that the periodical rise and fall in their waters occupy seven years appears not to be founded on authentic observation. Sand bars and beaches, or the inlets of certain bays, are regarded as the landmarks; and these being liable to fluctuation, from accumulation and removal, it follows that no hypothesis, founded on such observations, can be of any value. . . It is nevertheless true that there are important fluctuations in the Lake levels, which are unconnected with the temporary influence of winds. The only rational explanation of these changes yet afforded is that depending on the waste and supply of water. From the immense surface exposed to the sun's rays, it is plain that the amount of water evaporated is immense; and if by any means the process becomes retarded, the water is elevated. Again, the greater quantity of snow falling during certain seasons has been considered a sufficient reason for explaining the increased elevation of the Lakes. If after such a season a summer follows when there is a small degree of sunshine, the amount of evaporation being thus diminished, the Lakes remain at a high point. These causes, though perhaps satisfactory, and without doubt true, at least to a certain extent, do not always appear sufficient to account for the fluctuations which have been noticed. Twenty-five or thirty years ago the beach of Lake Erie was a travelled highway beyond Buffalo; but at this time it would be quite impossible to travel along the same. . . .

"From the united testimony of persons residing along the margins of all the Lakes, and from other demonstrative proofs, it appears that for many years previous to 1838, all the Lakes had been rising, that about that time they attained their maximum, and have since (to 1842) been subsiding. I have no means of determining the time or degree of the minimum depression. Mr. Higgins, the State Topographer of the Geological Survey of Michigan, gives the rise of the Lakes as five feet from 1819 to 1838, and regards it as probable that the minimum period continues for a considerable length of time, while the maximum continues only for a year. . . A single individual has informed me that about 1788 or 1790 the Lakes were nearly as high as in 1838. . . .

"The *annual* fluctuations in the level of the Lakes are doubtless due to the nature of the seasons, depending on the quantity of rain and snow, and the amount of the evaporation; but it is not so satisfactorily demonstrated that for a series of twenty years the quantity of rain and snow has increased, or that evaporation has lessened uniformly throughout that period.

"The effect of winds in producing (*daily*) temporary elevations and depressions is very remarkable. A strong westerly wind will raise the water in the eastern end of Lake Erie several feet in a few hours, when a much larger quantity is driven down the Niagara; and although so rapid a stream below the Falls, the water frequently rises fifteen or twenty feet during a westerly wind. At the same time the water is diminished at the western extremity of the Lake, and a corresponding depression there takes place. The prevalence of a strong easterly or northerly wind in the same way drives the waters to the western and southern parts of the Lake, and a much smaller quantity flows down the Niagara during such period. The same effects take place in a greater or less degree in all the Lakes—the rising at one extremity and the sinking at the other, till the wind subsides, when it resumes its equilibrium, and in so doing presents a beautiful exhibition of the long swells which are observed in the ocean after the subsidence of a high wind."

* See American Journal of Science, Vol. 16th, pp. 78 to 94, and Young's Natural Philosophy, Vol. 1, p. 578, &c. See also pp. 44 and 46 of this article.

† See Hall's Geology of New York, pp. 408 to 410.

Professor Hall was well seconded by Professor Mather, afterwards chief director of the Geological Survey of Ohio, and subsequently (in 1845, 46, and 47) a resident on the shores of Lake Superior, observant of the meteorology and change of level of that Lake, from whose reports and other writings I extract the following hurriedly condensed particulars respecting Lakes Erie and Superior:*

"A tradition exists that there is a periodical rise and fall in Lake Erie, through a certain number of years. If it is true—and there are reasons for believing that it may be so, to a certain extent—it is evident that the present rise (1838) is higher than has occurred for many years before, for extensive tracts of forest are now overflowed, and timber killed in consequence, the trees of which indicate a long period of growth. The causes that may concur to produce such a variation in the level of the Lake are: —1st, An obstruction to the drainage to the usual quantity of water, in consequence of which, if the usual supply continues, the water must rise. 2d, The increased or diminished supply of water, dependent on the wetness or dryness of the season, the relative temperature, and amount of evaporation, both from the surface of the Lake and the country which receives its drainage waters, and the amount of water supplied by the Lakes above, as Lakes Huron, Michigan, and Superior,—the amount of water contributed by which is due to the same general causes, with the possible addition of an increasing water-way from the cutting down of their outlets, and pouring down an additional supply. 3d, Another possible cause may be taken into account in the varying level (or upheaval) of the solid earth itself—examples of which are mentioned in various works on geology, as to be seen in part of the coast of Sweden, where it is said to be slowly rising at the present time."

To this the Professor well adds:—"It is considered an object of great importance to determine what are the *causes* of this effect; and it was therefore intended, if the Legislature had made an appropriation corresponding to the estimate, and with provisions to the Bill which was reported last Session, *to have set in train a series of observations in several localities on the Lake coast*, and in different parts of the States, so that by the period for the close of the survey, a determination of the causes of the rise and fall of the Lake may have been attained. All the aid which the various branches of meteorology could have secured would also have decided the question as to the small *tides*, which are said to be very sensible in some places."

To the foregoing remarks of Professor Mather, I may be permitted to add that it is much to be regretted that any circumstances should have prevented his excellent suggestion from being carried into effect; but that such having unfortunately been the case, it now remains for the *British* province of Canada to have the credit of completing so desirable a work, on a far more extended scale.

Turning again to Lake Superior, I am happy to be able to quote the following (abridged) remarks by the same writer:†

"The great rise and fall of the level of the waters of the great Lakes, through a series of years has been long noticed. The cause is doubtless due to a greater quantity of snow and rain, or of a lower mean temperature and diminished evaporation during the period of rise, and the reverse during the time of fall of the water-level. During 1838-39, the waters were higher than they had been before for at least two centuries. This is demonstrated by the large tracts of land that were inundated which were covered with forest trees, many of them the growth of ages. These trees were destroyed by the overflow round Lakes Erie and Huron, and on the Ste. Marie river, between Point Detour and the Sault Ste. Marie.

"We have no accounts of Lake Superior at that time; but there are facts that indicate a marked variation within a few years. In 1845 a rock in the middle of the entrance of Eagle Harbour, showed itself only in the trough of the waves; and the narrow outlet between the west end of Porter's Island and the mainland at Copper Harbour, was of such depth that loaded boats could enter without touching the rocks. In 1846, the rock at the mouth of Eagle Harbour was one-and-a-half feet above water; and boats could not get into Copper Harbour. In June, 1847, the rock above-mentioned was still more above water, and the outlet to Copper Harbour could be crossed by stepping on the projecting points of the reef, without wetting the feet; and during some depressions of the water by barometrical waves, it was laid almost entirely dry. From the 18th of June to the 6th of September there was a rise of full twelve inches. It has been observed on this Lake that the water is lowest in spring and highest in autumn. This is readily explained by the fact that in winter most of the ordinary supplies of water from the drainage of the surrounding country are cut off, by being converted into ice and snow; while evaporation from the surface of the Lake by the dry northern winds continues to carry away a very sensible quantity of water. During the spring, on the contrary, the snow and ice melt, and the accumulated stores of winter flow into the Lake in greater quantity than to compensate for the evaporation and the drainage at the outlet. . . During a century past the waters of Lake Superior cannot have been more than four feet above the level of 1847, for any considerable time, as is evident by the growth of trees of two feet in diameter at Porter's Island, which would have died had the ground around them been inundated for any great length of time."

To descend once more to Lake Erie. I am next indebted to Colonel Whittlesley, Topographer to the Geological Survey of Ohio for the following, confined to the annual and daily fluctuations in that Lake, with a variety of other acceptable details respecting particular sudden floods, as well as for a concise but imperfect tabular view of the *reported*, combined with the *known* annual variations in the level of its waters from 1796 to 1838.‡

"The general belief amongst navigators and residents on the Lakes appears to be uniform against the existence of any law by which these fluctuations are governed or may be predicted. The scanty information collected tends to the conclusion that these general elevations and depressions are *fortuitous*, and the result of accidental disorder in the seasons throughout the Lake country. It is, however, well established that there *is* in Lake Erie an *annual* tide, independent of the general state§ of the water, which rises from eight to fifteen inches in the mean. The minimum occurs about the time of the breaking up of the ice, late in winter, and the maximum late in spring or early in summer and fall. In the winter less change is perceptible; but early in spring it rises very fast, and with great regularity, till it reaches the maximum. All measurements should be taken subject to this change; but I am unable to fix a mean surface for the year,

* See Geological Report of Professor Mather for 1838.

† See Report of Geological Survey of Ohio for 1838–39; and an article in the American Journal of Science for July, 1848.

‡ See Colonel Whittlesley's Report for 1838-39.

§ *Stage* is the word used, meaning "*level*," I presume.—R. L.

or to give a probable error. . . The geographical position of Lake Erie in reference to the prevailing winds is the cause of irregularities in the *annual* rise and fall of its waters. Its general course being north-east and south-west, discharging at the north, the steady west wind of the fall accelerates the flow of water from this Lake, at the same time retarding its supply from the other Lakes.

"It has been asserted that there exists in the Lakes, as in the Ocean, a daily or *lunar* tide. Whether it is true when applied to Huron, Ontario, or other lakes, *is not perhaps entirely settled.* The observations I have been enabled to make on Lake Erie, and the uniform testimony of the waterman and harbour workmen coincide in denying the existence of any change resembling the Oceanic tide, and Mr. Davies, the Collector of Customs, writes decidedly: '*This is not the fact*; the examination of the tide-waiter kept at our office, and observations, made almost hourly since August last, enable me to assert, without fear of contradiction, that there is no tide upon Lake Erie.'"

It will be perceived that I already happen to possess more accumulated information on the vicissitudes of Lake Erie, to which my own attention and reflections had been more particularly directed, than of all the rest of our great Mediterranean seas put together ; and I have now the additional satisfaction of turning to the investigations of my more immediate neighbours, the State Geologists of Michigan, and more especially of their talented chief, the lamented late Dr. Houghton, and his able assistant and topographer, Mr. Higgins.

From the first Report of the former, however, I can only venture to point to the following naked paragraphs, on the change of elevation in the waters of the Lakes, as equally applicable to Canada as to the American States.*

"The great interest which this subject possesses, in connection with our Lake Harbours, as well as with those agricultural interests situated upon the flat lands bordering the Lakes and Rivers, may be a sufficient apology for the introduction of the following facts and reflections npon the subject. An accurate and satisfactory determination of the total rise and fall of the waters of the Lakes is a subject, the importance of which, in connection with some of our works of internal improvement and harbours, can at this time scarcely be appreciated.

"Much confusion is conceived to have arisen in the minds of a portion of our citizens, in consequence of a confounding of the regular *annual* rise and fall to which the waters of the Lakes are subject, with that apparently irregular elevation and subsidence which only appears to be completed in a series of years; changes that are conceived to depend upon causes so widely different, that, while the one can be calculated with almost the same certainty as the return of the seasons, the other can by no means be calculated with *any* degree of certainty.

"It is well known to those who have been accustomed to notice the relative height of the water of the Lakes, that during the winter season, while the flow of water from the small streams is either partially or wholly checked by ice, and while the springs fail to discharge their accustomed quantity, the water of the Lakes is invariably low. As the spring advances the snow that had fallen during the winter is changed to water, the springs receive their accustomed supply, and the small streams are again opened, their banks being full in proportion to the amount of snow which may have fallen during the winter, added to the rapidity with which it may have been melted. The water of the Lakes, in consequence of this suddenly increased quantity received from the immense number of tributaries, commences rising with the first opening of the spring, and usually attains its greatest elevation—at least in the upper Lakes—sometime in the month of June or July. As the seasons advance, or during the summer and a large portion of the autumnal months, evaporation is increased, and the amount of water discharged by the streams lessened, in consequence of which the water of the Lakes falls very gradually until the winter again sets in, when a still greater depression takes place, from the renewed operations of the causes already mentioned.

"The *extreme variation* in the height of the water from winter to summer is subject to considerable change, according as the winters may vary from cold and dry to warm and wet; but during the past eight years it may be estimated at two feet.

"The annual rise and fall of the waters of the Lakes, dependent, as it manifestly is, upon causes which are somewhat uniform in their operation, must not be confounded with that elevation and depression to which the waters are subject, independent of causes connected with the seasons of the year. These latter changes, which take place more gradually, sometimes undergoing but little variation for a series of years, are least liable to be noticed, unless they be very considerable; but with respect to *consequences*, they are of vastly more importance, since they are subject to a larger and more permanent range.

"That the waters of the Lakes, from the earliest settlement of the country have been subject to considerable variation in relative height is well known. At one time the belief was very general that these changes took place at regular intervals, rising for a space of seven years, and subsiding for a similar length of time: a belief which would appear to be in consonance with that of the Indians, and with whom it, no doubt, originated. It is not wonderful that a subject, the causes of which are so little comprehended by our natives should be invested with an air of mystery, or that an error once propagated, in consequence of the long series of years required to bring about any considerable change, could scarcely be eradicated. While the idea of that septennial rise and fall must be regarded as founded in error, it is nevertheless true, that from the earliest records, the height of the Lakes has been subject to a considerable variation, usually rising very gradually and irregularly for a series of years, and after that falling in a similar, but more rapid, manner."

Dr. Houghton concludes a number of other excellent elucidatory remarks, by observing, with regard to the succession of previous cold and wet seasons which produced the great *rise* in 1838—that, "when we take into consideration, in connection with the causes enumerated, the *fact* that during the wet years evaporation must have been less than during the dry ones, it may be fairly presumed that sufficient apparent causes have existed to produce all the results noticed; and we may add, should such a succession of dry and warm seasons follow, we may look with certainty for a return of the Lakes to the former low level."

In consequence of the great length of the foregoing quotation, I must be content with giving only the following abridged and disjointed particulars on the same subject from Mr. Higgins' Reports of 1839 and 1841:—"That interesting question, the periodical rise and fall of the Lakes, has given rise to a variety of curious speculations. The inference drawn from the following data, it is presumed, will not be altogether inconclusive. Calcu-

* See Geological Report of Michigan for 1839, p. 20 to 22.

lations may be made sufficiently accurate to determine nearly the amount of surface drained; and if our climate, as is alleged, shows a successive series of cold and moist years, and of warm and dry ones, mutually following each other, variations in the volume of water cannot but be great. Taking into account only the central and upper divisions of the St. Lawrence valley, from Niagara to the North-west angle of Lake Superior, embracing all the country whose streams are tributary to the Lakes, the surface drained is calculated (as shewn by a table of sections) at 248,775 square miles, besides 86,760 square miles occupied by the Lakes; and it is further calculated that the enormous accumulation of water discharged through the River Detroit during high floods, allowing a current of only one mile an hour, is not less than 95,135,000 cubic feet per hour, or 1,585,558 cubic feet per minute. The floods on Lake Ontario, however, are generally the highest by about two feet; and for this obvious reason, that it receives the successive accumulations of all the Lakes, from the Niagara to the St. Louis Rivers, at the head of Lake Superior.

According to Mr. Mather's report for 1841, which is the next testimony to be adduced: "The preceding year (1840) was the second since the unusual elevation of the waters of the Lakes, since which time there had been a remarkable coincidence in the ratios of subsidence, the more unlooked for when taken in connection with the causes which tend to equalize the amount of falling water in the form of rain, snow, and dew, with the constant action of evaporation." * * * *

"The diminution in a given quantity of water exceeds by evaporation all the supplies which it receives from rain—*i.e.*, the average amount of falling water is equal per year to thirty-three inches; but the evaporation will reduce it to forty-four inches, when fully exposed to the sun and air. One season of extreme drought would, upon the expanse of these Lakes produce an extreme depression, while the contrary would produce a corresponding rise. It cannot then be matter of much astonishment that such expanded areas of water, subject to such influences should be greatly affected. The wonder is that they do not oftener present greater fluctuations. The equal and almost unvarying stage at which we find them is due to the conformity of the seasons, and the systematic order in which nature conducts all her works.

"The *semi-annual* alterations observable in summer and winter arise from other well known causes. In summer the supply is unchecked, and the consequence is an increase to the height of about thirty inches; when in winter these supplies are again checked, a consequent depression follows. Measures to ascertain exactly the semi-annual fluctuations have never been thought necessary. *Besides it is not uncommon for ice in large bodies to collect at the outlets of the Lakes, and for a time prevent the usual discharge, as was the case at the outlet of Lake Huron in connection with a west wind in* 1824 *and* 1831, *when the depth in the Detroit River opposite the City of Detroit was diminished over ten feet.*" * * * * *

"Besides all this, the effect of winds acts sometimes in favour as well as against the other irregularities. The geographical position of the Lakes is such as, that allowing them to prevail from the same point at the same time, over them all, *which is by no means always the case*, they produce a variety of results. A west wind forces the waters of Lake Erie into the Niagara River, at the same time that the waters from the foot of Lakes Huron and Michigan are forced into the straits of Michillimackinac, and there again are met by the waters of Lake Superior, through the straits of Ste. Marie. Hence the straits which connect Lakes Huron and Erie have all the indications of a tide, though irregular as to time, as well as to the amount of its elevation and depression; and it has often both risen and fallen in about the same proportion, and sometimes in the same periods as the lunar tides of those Rivers which empty into the Ocean. But when even these tides take place, either in the Lakes themselves, or in the straits connecting them, they are fortuitous, and the results of accidental disorder common throughout the Lake region.—Another feature may be observed of the Lakes, different in nothing from the ground swell of the Ocean—the reaction of the water—after having been pressed by the wind a few days or hours in one direction;—the most favourable point for noticing which is at an outlet or bay, and Lake Superior having the largest surface presents the most favourable traits of such reaction."

Having thus nearly exhausted my scattered extracts and notes, derived from American authorities, it now remains to refer to a few more memoranda on the same interesting subject, derived from British writers, such as Sir Richard Bonnycastle, Mr. McGregor, Mr. Talbot and others. Among these I turn first to Sir Richard's work on Canada, from which I find taken the following disjointed extracts.*

"The Lakes of Canada have not engaged that attention *at home*, which they ought to have had; and there is much information about them which is a dead letter in England. Their rise and fall is a subject of great interest. The great sinking of their levels of late years, which has become so visible, and injurious to commerce, deserves the most attentive observation. The American writers attribute it to various causes; and there are as many theories about it as there are upon all hidden mysteries. Evaporation and condensation, woods and glaciers, have all been brought into play. If the Lakes are supplied by their own Rivers, and by the drainage streams of the surrounding forests; and all this is again and again returned to them from the clouds, whence arises the sudden elevation or the sudden depression of such enormous bodies of water which have no tides? * * * Where do the Lakes receive that enormous supply which restores them to their usual flow? or are they permanently diminishing? I am inclined to believe that the latter is the case, as cultivation and the clearing of the forests proceed; for I have observed within fifteen years the total drying up of streamlets since the removal of the forest; and these streamlets had evidently once even been rivulets, and even rivers of some size, as their banks cut through alluvial soils plainly indicate. * * * Perhaps, whenever a *cycle* of years occurs, in which the north-east wind prevails during a year, or a series of years, the lakes lose their level; for the direction being north-east by south-west such is the usual current of the air, and therefore either north-east or south-westerly winds are the usual ones which pass over the surface. Whenever southerly winds prevail,—and in the cycle of the gyration of atmospheric currents this is certain, and will be reduced to calculations,—the great Lakes are filled to the edge; and whenever north and north-easterly winds take their appointed course, then these Mediterraneans sink, and the valley of the Mississippi is filled to overflowing. * * * But the most curious facts are that the different Lakes exhibit different phenomena: the Board of Works of Ohio having stated that in 1837–8, the water desending from the atmosphere did not exceed

* See Bonnycastle's Canada in 1840, pp. 276, 291 to 300

one-third of that which was the minimum of several preceding years.

"Ontario, from the reports of professional men, has varied not less than eight feet; and Erie about five. Huron and Superior, being comparatively unknown, no dates are afforded to judge of them. But what vast atmospheric agencies must have been at work when such wonderful results on the smaller Lakes have been made evident!"

"*What a useful thing*," further observes Sir Richard, *it would have been, if scientific navigators, or resident observers had registered the rise and fall of the Lakes in the years since Canada came into our possession.*"

Among other unconnected notes I find also some judicious remarks, extracted from McGregor's British America;* but from these I must be content to quote only the following, as referring to a collateral philosophical question of deep interest which may perhaps be touched on in the sequel: namely, the possibility of there being a subterraneous outlet to some of the great Lakes—a hypothesis which I have long been disposed to regard as not altogether irreconcilable with the geological formation of the basins of the middle and lower lakes, though perhaps not so with the structure of the Lake Superior regions; it being doubted whether, notwithstanding the great annual evaporation, the volume of water discharged by Lake Erie *does* sufficiently account for the vast united supply received by it from the immense triple resources of Lakes Superior, Michigan, and Huron.

"As the temperature of the climate in America depends chiefly on the winds, the formation of that continent is evidently the cause of the frosts being more intense than in countries in parallel latitudes in Europe; a consequence arising principally from the much greater breadth of America towards the poles. Winds change their character in America. North-east winds, which are cold and dry in Europe, are wet and truly disagreeable in America. North-west winds are, on the contrary, cold and dry, and are frequent during winter in America, much about the same period that north-easterly winds prevail in Europe. One great, if not the principal, cause of cold in America is the direction of the mountainous ranges and basins of country which conduct or influence the course of the winds. While the sun is to the south of the equator, the winds less under solar influence prevail from the north-west, following, however, the great features of the continent. The winds blowing over the vast regions of the north are always piercing and intensely cold. The return of the sun, again, by the diffusion of heat, agitates the atmosphere and alters the winds, which blow from a contrary direction, till the equilibrium is produced. This, however, does not appear to require much time, as no wind blows scarcely forty hours together from any one point.

"The comparative depths of the Lakes forms another extraordinary subject of enquiry. The bottom of Lake Ontario, which is 452 feet deep, is as low as most parts of the Gulf of St. Lawrence, while Lake Erie is only 60 or 70 feet deep; but the bottoms of Lakes Huron,† Michigan, and Superior, are all, from their vast depth, although their surface is so much higher, on a level with the bottom of Lake Ontario. This is certainly not impossible; nor does the discharge through the Detroit river—allowing for the full probable portion carried off by evaporation—appear by any means equal to the quantity of water which the three upper great Lakes may be considered to receive. All the Lakes are estimated to cover 43,040,000 acres. The great Lakes occasionally rise above their usual level from three to five feet. These overflowings are not annual nor regular. They have occurred about once in seven years, and are probably the effect of more rain and less evaporation during the seasons in which they take place. Sir George Mackenzie observed occasional overflowings of two to three feet in the Lakes north-west of Lake Superior; so that they are not peculiar to the Lakes of the St. Lawrence."

Having at length nearly exhausted my miscellaneous quotations and notes, I propose concluding that main branch of my task with the following appropriate remark, derived from a note at page 133 of the 1st volume of Talbot's Canada, as not only bearing on the now generally admitted influence of prevailing winds on the temporary fluctuations in the level of the Lakes, but also as adverting to the almost equally demonstrable fact, that the singular *severity* of our Canadian winters, and more particularly those of Lower Canada, compared with European countries in the same parallels of latitude, is altogether uninfluenced by the vast extent of our Lakes; on which subjects the author referred to, quoting an American author, states as follows:—

"Professor Dwight has proved that the height of the river (Niagara) both above and below the Falls, depends on the quarter from which the wind blows. Lake Erie, he says, is regularly raised at the eastern end, where the Fall commences, by every wind blowing between north-west and south-west. A strong westerly wind elevates its surface six feet above its ordinary level. The rivers must, of course, be proportionally elevated; and at the outlet must, when such a wind blows, be six feet higher than the *usual* water mark. . . On the contrary, when the wind blows from the north-east (the only easterly wind which in this region is of any importance), the waters of Lake Erie must recede of course, and fall considerably below their usual level, and the river be necessarily lower than at any other time."

The same author, in another part of his work (pp. 339 to 342), remarks as follows, with regard to the climate of Canada differing from that of European countries in a similar latitude:—

"The cause of this phenomenon appears to have eluded the most diligent and profound research. Many writers attribute the severity of the winter to the astonishing prevalence of north-west winds, and the amazing extent of the Lakes. That the severity of the weather in winter cannot with any propriety be attributed to the influence of the Lakes will appear evident to every man who reflects that the shores of those great inland seas enjoy a much milder climate than any other part of the country in the same parallels of latitude, however remotely situated from them. Fruit trees thrive well and bring their fruits to great perfection along the north-west extremity of Lake Ontario, in lat. 43 deg 30 min., and along the north shore of Lake Erie; and yet at 35 miles from the latter place, and in lat. 42 deg. 20 min., this fruit cannot be cultivated; and I have also seen snow three feet in depth a degree south of Lake Ontario, while at the same time it did not exceed six inches in the immediate vicinity of that Lake."‡

* See McGregor's British America, vol. 1, pp. 131 to 133.

† As an instance of our ignorance of the true depth of some of our Lakes, it is proper to note here that that of Lake Huron has, after all, been lately ascertained by the American Coast Survey to be not more than 420 instead of 860 feet!—R. L.

‡ See the letter introductory to my late paper on the establishment of a system of meteorological observations; and also the note at the foot of page 293 of this *Journal*.—R. L.

Leaving any further remarks on the foregoing for a future probable opportunity, I may here shortly observe, that I have long been persuaded that the severity of our winters is mitigated by the proximity of the Lakes, and is not so much owing to the prevalence of winds from the north-west, as a mere northerly point of the compass, or to the remarkable curve of the great isothermal line in this part of the globe, as to the winds alluded to sweeping down from a *more elevated region*, many parts of the extensive mountainous tract of country stretching in that direction being perhaps thousands of feet above the level of Lake Superior, and even the latter not being less than 600 feet above that of the ocean.

Nearly the whole of the conflicting evidence bearing on the various points at issue having been adduced, I proceed to state freely, yet as briefly as possible, the mode of proceeding adopted by me, in my endeavour to arrive at the convictions to which I have been thereby led with respect to each of the three questions to be determined.

To commence with the first of these, namely, the traditional report of there being a septennial rise and fall in the waters of the great Lakes, &c., I have to remark, that being unwilling to admit any assertions on so interesting and mysterious a phenomenon without thorough examination and comparison with facts, I, after much reflection, determined to attempt to form from the materials in my possession a general comparative tabular view of the positively known, and, failing that, generally acknowledged periods of elevation and depression throughout the whole of the Lakes during the longest ascertainable series of years; in the hope of thereby arriving at something like an approximation to the real state of the matter; but after labouring long and patiently at the unsatisfactory task, I was at last obliged to abandon it, and confine my synopsis to Lake Erie alone, and even then to leave a broad "Column of Remarks" for the insertion of any apparent coincidence, or otherwise, in the state of the other Lakes; and in this I continued to persevere till, after much labour, I so far succeeded, as is shown in the following copious yet imperfect Table, exhibiting not only the various progressive and retrogressive annual fluctuations in the level of that particular Lake during a course of sixty-three years, as vouched by the different highly respectable authorities named, but also proving, incidentally, how far that long-received traditional phenomenon, the rise and fall of the Lakes generally every seven years, is in accordance with the evidence furnished by recorded facts:—

COMPARATIVE VIEW OF THE RISE AND FALL OF THE WATERS OF LAKE ERIE,

FOR SIXTY-THREE YEARS, IN SUCCESSION, AS FAR AS ASCERTAINED FROM THE BEST SOURCES OF INFORMATION WITHIN REACH.

DATE.	COMPARATIVE LEVEL.	AUTHORITIES.	MISCELLANEOUS REMARKS.
1790..	*1st maximum;* being 5 ft. 6 in. above lowest level.	Prof. Hall, Higgens, Whittesley, Mather, &c.	From 1788 to 1790, the Lakes generally, and Lake Erie in particular, stated to have been as high as in 1838, at which time, according to different authorities, compared with the lowest level known, it was estimated at 5 ft. 3 in., 5 ft. 4 in., and even 6 ft.; and Prof. Hall mentions evidence of a higher level than in 1838, in ridges and submerged trees.
91..			
92, 93, 94	No information regarding these years.		
95, 96	*1st minimum.* Level described as low, but not exactly stated.	Weld, Whittesley, &c.	During 1795 and 1796, *Lake Ontario* described as so high as to have drowned orchards near Kingston of 30 years growth, while the gravelly beach of Lake Erie near Cleveland was used as a road, and continued so for many years afterwards.
97, 98, 99	Rising, but amount not stated.	Do. do. do.	In 1798, Lake Erie reported as higher than in 1796.
1800, 1, 2	High. *2nd maximum.*	Higgens, Houghton, Whiting, &c.	Waters of Lake Erie, and of the others generally, high from 1800 to 1802; and the level loosely estimated as similar to that of 1827.
3, 4, 5	No information whatever.		
6..	Level low.	Whittesley, &c.	Level reported, in general terms, as low.
7, 8, 9	Rising. No information.		
1810, 11	*2nd minimum.* Reported as 6 feet below 1838.	Do. do.	The level of this year is compared with the floods of 1790 and 1838: which would give about 2 ft. 9 in. below the mean level.
12, 13, 14	Waters rising.	Houghton, Higgens, Dearborn, Whiting, &c.	Gen. Dearborn states, from personal knowledge, that *Lake Erie* was, in 1814, more than 2 feet higher than in 1813, and that the river Detroit was unusually high during that and the following year, and much land submerged: Dr. Houghton describes the Detroit as high in 1814 and 1815; and Mr. Higgens the Upper Lakes as full in 1814, and the central and lower Lakes in 1815.
15..	*3rd maximum*, but 2 ft. less than 1838.	Do. do. do.	In 1815, like previous year, Detroit and St. Clair Rivers unusually full, and the rise of Ontario regarded as generally about 2 feet higher than the other Lakes.
16..	Same as last year.		
17, 18	Falling.	Houghton, Higgens, &c.	In 1817 and 1819, an ebb and flow of from 14 to 18 inches, noticed at Green Bay by Major Storrow, and in 1820 by Mr. Schoolcraft, and in 1827 by Col. Whiting.
19, 1820	*3rd minimum*, or Zero.	Do., do., and Whittesley, Whiting.	In 1819 and 1820, the central and lower Lakes described by Messrs. Higgens and Whittesley as unusually low; while Col. Whiting and Dr. Houghton state that the Detroit River had resumed its usual level.
21..	Rising rapidly.	Do., do., do., Dearborn, M'Taggart.	Lakes Huron and Erie described as having resumed their usual level during this year.
22..	Do., but still low.	Do.	
23..	Up to average or mean.	Do.	This year a rapid rise of 2 feet, from 5 to 3 feet below 1838.
24, 25, 26	Gradually rising, to within 2 feet of maximum of 1838.		In 1824, ice for a time blocked up outlet of Lake Huron, and river Detroit in consequence fell rapidly 10 feet; and a great depression took place in Lakes Erie and Ontario, while the pent-up waters flowed back on Lake Huron. In other respects, the Lakes appear to have been in their usual state. In 1831, a similar occurrence.
27, 28	*4th maximum*, reckoned as high as in 1815.	Houghton, Higgens, Whiting, Dearborn, M'Taggart, &c.	In 1827 and 1828. Lake Ontario (and other Lakes) 2 feet higher than 1820; and yet, according to Mr. M'Taggart (who estimates extra height between 2 and 3 feet), the rivers flowing out of them did not appear to be affected thereby; while Gen. Dearborn states that, though Lakes Erie and Ontario were so high, Lake Superior was lower than ever known before. In 1830, the level of Lake Erie rated at 2 feet above 1819.
29	Still high.		
1830	As high as in 1828.		

DATE.	COMPARATIVE LEVEL.	AUTHORITIES.	MISCELLANEOUS REMARKS.
31..	Subsiding rapidly.	Whiting, &c.	This year Lake Erie fell temporarily between 3 and 4 feet. (See also 1824.)
32, 33	*4th minimum*, though only down to average.	Whittesley, Higgens.	By *average* is meant the *mean*, or half-way between the two extremes—say 2 feet 9 inches below the maximum of 1838.
34..	Rising.	Houghton, Higgens, Mather, Whiting, Whittesley, Buffalo *Advertiser*, *Canadian Journal*, &c.	In 1835, Lake considered 1 ft. 8 in. higher than in 1819; and afterwards in 1842.
35..	2 feet 10 inches below 1838.		In 1836, level the same as in 1830, and subsequently in 1853, and 1 ft. higher than the previous year. *N.B.*—The figures in the "Comparative Level" column to 1838 from Mr. Higgens.
36..	1 " 8 " do.		
37..	0 " 9 " do.		
38..	*5th maximum.* 5 feet 3 inches above Zero.	*American Journal of Science*, Prof. Dewey, Buffalo *Express*, Niagara Fall's *Iris*, Chatham *Planet*, &c.	In 1838, Lake stated by Higgens to be 5 ft. 3 in. above 1819, and by Buffalo *Advertiser* 5 ft. 4 in. in June, and 5 ft. 9 in. in August; and according to Dr. Houghton, it might be 6 ft.: much land overflowed, and trees of 100 years growth killed. Lake Ontario said to be 6 ft. 10 in. above 1825, Lake Huron higher than for two centuries, Michigan 6 ft. higher than in 1820, and Superior said to be 3 ft. higher than usual, and 1 ft. above 1837. By February, 1839, Erie had fallen to 3 ft. 8 in. (see also 1827), and in 1840 it was higher than for 23 years before, with the exception of 1838. *N.B.*—The levels in figures from 1839 to 1851 from Buffalo *Advertiser* of April, 1851.
39..	3 " 8 " do.		
1840..	3 " 5 " do.		
41..	3 " 1 " do.		
42..	3 " 7 " do.		
43..	2 " 8 " do.	*N.B.*—In contrast to Lake Erie, from 1846 to 1852, Lake Ontario was as follows at mouth of Genessee River:—	
44..	2 " 11 " do.		In 1844, all the Lakes considered low; but during the night of 18th October, Lake Erie suddenly rose temporarily at Buffalo 13 ft. 8 in. above the harbour Zero, caused by a great storm. In 1845, a sudden rise and fall of Lake Ontario, caused (according to Prof. Dewey) by a tornado, with water-spout, thunder, and hail. In that year, however, Lakes Erie, Huron, and Michigan much lower than usual; and in Lake Superior, a rock at the entrance of Eagle Harbour appeared above water, and next year was 1½ ft. high, and in next year still higher. In 1846, Gull Island (a light-house station in Lake Ontario) reappeared, after having been submerged 7 years. In January, 1847, sudden flux and reflux of Lake Ontario near Cobourg, when the waters receded 350 ft., and returned in an unbroken wave 4 ft. high; repeated 7 or 8 times, till it gradually assumed its usual appearance. On 30th March, outlet of Lake Erie temporarily blocked up with ice, so as to leave the Table Rock at Niagara Falls, and 200 ft. beyond it, dry. On 18th April, a sudden temporary depression of Lake Erie at Buffalo to 22 in. below Zero' caused by a strong gale from the N.E. In 1851, *Lake Erie*, at Port Colborne, was 3 ft. higher than in 1850; and in 1852 very little change; and in 1853 level nearly the same as in 1838 and 1830. In 1852, *Lake Ontario* 1 ft. 2 in. higher than in 1851; and in 1853, 9 in. higher, and calculated to be the same as in 1830 and 1838, and 4 ft. 5 in. above the minimum of 1849. In 1853, the River St. Lawrence generally considered as very high.
45..	3 " 0 " do.		
46..	2 " 0 *5th minimum.*		
47..	2 " 6 " above Zero.	2 ft. 3 in. from top of dock.	
48..	2 " 2 " do.	1 1 do.	
49..	3 " 1 " do.	2 1 do.	
1850..	2 " 8 " do.	1 9 do.	
51..	2 " 11 " do.	1 5 do.	
52..	Rising rapidly.	1 11 in July, do.	
53..	*6th maximum;* very high, as in 1832.	1 2 do.	
54..			

General Remark.—It is estimated that the Lakes subside irregularly, between the great periodical floods, at the rate of about 1 ft. 4 in. per annum; but that the comparative rapidity of the *fall* is as about 2 years, to 5 of the rise; and that the waters remain for some time at the mean level. Mr. Murray observes of Lake Huron, in his Report of 1848, that its waters have sunk considerably below former (perhaps ancient) levels, as indicated by water-marks, to the extent of 4 feet 10 inches.

While leaving the details of the foregoing Table to speak for themselves, I may be permitted to superadd, that the column of "*Comparative level*," however imperfect, is as complete as my materials would furnish; and that the greater part of the names there registered will be found among the different writers to whom I have had occasion to refer, or quote from, in the course of the foregoing remarks, besides several other sources of information to which I may hereafter have to advert; and further, that I have, in the column of "*Miscellaneous remarks*," taken care to refer to all such information of a loose *comparative* nature as appeared too indefinite for being admitted into the column of "*Authorities*," though not altogether to be rejected as without value; as well as to note not only any remarkable temporary derangements in the usual flow of Lake Erie, but any coincidence of level, or other remarkable event, connected with the state of the other Lakes at the same time. From a careful perusal of all details, I am disposed to think it will, in the first place, be satisfactorily demonstrated that not only there is no *regular* septennial or other great flood in Lake Erie, or any other of the great Lakes, but that, though in 1838 the whole of our inland waters happened to be simultaneously at an extraordinary height, it is very problematical whether they will always be found in an elevated or depressed state at the same time. For instance, taking it for granted that 1789–90 was really a maximum year, it will be seen by a reference to the Table, that instead of an interval of 14 years, the next maximum took place in 10 years, or in 1800–1; and that the next great flood was fortuitously in 1815; but that the next was in 1828; the next in 1838; and the last in 1853; and that, as might be reasonably expected, the advent of the mean and maximum periods was still less to be depended on. I am therefore bound to coincide in the more rational, and now generally received *opinion*, that the intervals at which these extraordinary floods occur are, at the best, uncertain, and mainly dependent on the extra amount of rain and snow, and the less degree of evaporation during the summer months, in that particular year; and that though the rise and fall in the different Lakes may, under ordinary circumstances, be generally simultaneous, it does not follow that such will always be the case; or, in other words, that there may sometimes be a rise for a season, or part of a season, in one Lake, altogether independent of the others, arising from temporary obstructions at its outlet—a conclusion which I have arrived at, after much inquiry, observation, and reflection, in addition to the evidence furnished in the foregoing Table,—as will be found more particularly adverted to immediately.

2ndly. With regard to the *annual* variations in the level of the Lakes, and their general extent; and how far these also occur simultaneously, and are likewise owing to the amount of rain and snow compared with that of the evaporation; or what other cause:—I am free to confess that, *cæteris paribus*, and in accordance with the various authorities adduced, as well as all other information which I have been enabled to obtain, the same observation must apply to these variations as to the septennial fluctuations just noticed; but that while the extremes between the maximum and minimum range of the great floods may be rated at about 6 feet, the average difference of level during a single year may be between 2 and 3 feet; and that, as already stated, though the rise and fall in all the Lakes may usually be simultaneous, one may sometimes be low while the others are high. As, for instance, it will be seen by a reference to the column of "Miscellaneous Remarks," that in 1795–96, Lake Ontario was so high as to drown trees of many years' growth, while Lake Erie was described as so low that the gravelly beach near Cleveland was used as a public road; and that in 1814, "the upper Lakes were full,"

whereas "the centre and lower Lakes" were not so till the following year; and that in 1827 Lakes Erie and Ontario were between two and three feet above their usual level, while Lake Superior was lower than ever known before;—all which circumstances combined, with others yet to be noticed, have produced a conviction that each Lake is independently liable to irregularities of level peculiar to itself. I allude to the well-known, but little thought of, *fact*, that during the winter months large boulders, as well as smaller masses of stone and gravel, lying along shore, become firmly imbedded in the bordage ice, and on any rise of the waters, towards the close of the season, remain firmly attached to the moving floating masses, liable to be either dropt again in deep water, on the ice becoming what is called rotten, or to be removed to some distant part of the shore, if not to be carried along by the united wind and current towards the outlet of the Lake. Admitting such to be the case—for there is every year abundant evidence of the fact—it only remains to suppose that towards the end of winter, as frequently occurs, an accumulation of loaded drift ice takes place near the head of the Rapids in the neighbourhood of Buffalo, and becomes temporarily united by a fresh frost, and that a *jam*, as it is termed, then takes place, so as to leave a more contracted space than usual for the passage of the rushing volume of water below the broad roofing of ice, and that a further rise afterwards happens, coupled with a thaw, during which a deposition of the hitherto suspended rocky materials takes place at the bottom of the channel, it will be evident that a still more contracted space will be left for the discharge of the increasing flood; and the natural consequence will be, that after the breaking up of the ice, the general surface of the Lake will have assumed a higher level than would have otherwise been the case, proportioned to the thickness of the stratum of boulders and other rocky materials deposited at the bottom of the channel,—liable to remain for a longer or shorter time, until gradually removed by the action of the sweeping current: a process altogether dependent on the strength of the latter, compared with the degree of compactness and solidification acquired by the rocky barrier opposed to it; and which may therefore require a whole season, or even more, to be accomplished. Of the motive power of ice, I myself have had ample proof, in the frequent dislodgment of boulders of large size from one part of the Lake shore to another, near my own farm; but more particularly of a vast rugged mass of limestone rock moved from comparatively deep water, some distance out in the Lake, to a more shallow part, so near the shore, that a large tree, dislodged from the high bank above by the undermining fury of the waves, happened to fall over in such a manner that its stem formed a very convenient though giddy bridge, from the beach to the stranger rock, and thereby allowed the latter to be afterwards used as a pleasant fishing station by my children. There are also, to my own knowledge, many instances of the removal of boulders in the different parts of the Rapids near Montreal. And among many examples of the almost entire temporary obstruction of the outlets of Lakes Huron and Erie by the jamming of the ice, I shall append to this paper an account of one which took place in the Niagara River, between Buffalo and Fort Erie, in March, 1848, with which I was at the time so much struck that I was induced to write to a friend on the spot for further particulars, in hopes of elucidating my long-cherished hypothesis; and such I have no doubt would have been the case, had I been able to be present myself to compare facts. Independent of that, however, the particulars connected with the obstruction in the Niagara* alluded to, were of so extraordinary a character as to deserve being placed on permanent record.

With respect to the 3d debateable question—the daily oscillations or other irregular transient tides observable in the different Lakes; I may observe that, making allowance for a greater or less degree of barometrical pressure, I might perhaps be disposed to assent in few words to the now generally received opinion, that in other respects they may be ascribed to the influence of the prevailing winds upon their broad expanse, more or less modified by their peculiar form and direction, and the relative bearing and nature of their extremities, as well as by the often very jagged and irregular outline of particular inlets or bays, and other inter-peninsular localities, such as Kewenaw Bay on Lake Superior, Green Bay on Lake Michigan, Presque Isle Peninsula and Long Point on Lake Erie, and the Bay of Quinté on Lake Ontario. But it seems to me that in so doing I would be conceding too much, as, in my humble unscientific apprehension, I am disposed to think that though such may be the case to a general extent, it is not the less necessary to prove, by a long and regular course of minute observations, whether such be the fact or not, as well as how far the surface of such vast bodies of water may not at times be considerably influenced by barometrical pressure on the one hand, or by lunar attraction on the other, particularly at the times of the vernal and autumnal equinoxes; and the more so, considering that late observations of philosophers in Europe have not only decided that there is a perceptible tide in the Mediterranean, Euxine, and Baltic, as well as in other altogether close saline seas, but also that something like barometric and lunar influence, or both, is observable on the inland fresh-water lakes of Switzerland and elsewhere. In confirmation of this I would, as regards the latter, beg to refer to the writings of Dr. Young, alluded to in an early part of these remarks, in conjunction with a valuable paper on the Lakes of Switzerland, by Colonel Jackson of the Royal Geographical Society, which lately appeared in the *Canadian Journal*, incorporated in a series of interesting articles on the variations in the level of the Canadian Lakes, from the pen of its learned editor, in which those oscillations (there termed *seiches*) are said to amount to no less than five feet. Nay, so interestingly appropriate to the present question do I regard a portion of the article alluded to, that I am tempted, in spite of the already great length of this paper, to transcribe the following, as the conclusion at which a learned German Professor has arrived on the subject:—"1st. That the *seiches* of the Lake of Geneva are much more frequent than is generally imagined. 2d. That they happen at all seasons of the year, and at all hours of the day; but that they are generally most severe in the spring and in the autumn. 3d. That the state of the atmosphere seems to have a decided influence, it being remarked, that in proportion as that state is less changeable, so are the Seiches less frequent, and *vice versa*. The Seiches have always been considerable when the atmosphere has been loaded with heavy clouds, or when the weather, in other respects severe, has threatened to be stormy, and when the barometer has sunk. 4th. That though Seiches are more frequent in spring and autumn, they are more considerable in the summer, and, in particular, towards the close of the season. The highest that have been observed happened in the month of September. 5th. That the minimum of the Seiches has no precise term: their maximum seems to be five feet. 6th. That although the duration of the Seiches is very variable, the greatest extent seems not to exceed 20 or 25 minutes, but usually lasts a much shorter time. And 7th, That they are not peculiar to the Lake of Geneva alone; M. Vaucher having observed them on the Lakes of Zurich, of Annecy, and of Constance.

* The account of this singular phenomenon is unavoidably postponed till some future time.

I cannot refrain from also quoting the following paragraph from the same paper, as much to the point:—

"It appears unquestionable that the phenomenon of the Seiches is due to an unequal pressure of the atmosphere in different parts of the Lake at the same time, *i. e.*, to the simultaneous effects of columns of air of different weight, or different elasticity, arising from temporary variations of temperature, or from mechanical causes; and if such be the case, all Lakes of a certain extent, and even inland seas, must be subject to the same influence, and therefore present the same phenomenon; and I have little doubt that correct observations will verify the presumption."*

With respect to the irregular tides observable in the Baltic and Black Seas, and other great bodies of saline water of a similar character, it will be sufficient to give the following, regarding the first-named sea, from a standard geographical work, as bearing intimately on the subject under discussion:—"The Baltic being a close sea, is of course not subject to the phenomena of regular tides. But though such be wanting, a variation in the height of its waters, equal, frequently, to $3\frac{1}{2}$ feet Swedish, is observed at irregular intervals. This occurs at all seasons, but chiefly in the autumn or winter, at the time of heavy rains, or when the atmosphere is charged with clouds, though unattended with falling weather. The water maintains its height frequently for several days, sometimes even for weeks. Prevalent winds, flooding rains, melting snows, and many other causes were assigned for this very remarkable phenomenon; but it continued to occur, independent of all these, till 1804, when Schulten, a Swedish physician, after having collected all the observations that had been made, found 'that the greatest height of the water corresponds with the greatest depression of the barometrical column; and conversely.' The almost total absence of oceanic action in this sea leaves the cause thus assigned to operate with full power; and if Schulten's hypothesis be confirmed, of which there is now but little doubt, it will, in all probability, serve to explain similar phenomena observed in other close waters, as the Caspian, Lake Balkai, and the Lake of Geneva, to which Saussure has assigned similar causes."†

To conclude. Having at last completed my retrospect of the state of the interesting philosophical questions which have so long engaged my attention, and having, in so doing, far exceeded the limits which I had prescribed to myself when I first ventured to press upon the Institute the establishment of a series of observations on the rise and fall of our noble Lakes, combined with that of a system of simultaneous meteorological observations throughout the country, it will not be wondered that I should bring my desultory remarks to an abrupt close. Reserving, therefore, any further expression of opinion until the fate of my proposal shall have been decided, I shall at present only add an earnest entreaty that, whatever may be the humble merits of the discursive review which I have taken of the important subject under discussion, it will at all events be received with indulgence; and that the Institute will be induced to take the trouble of patiently separating whatever *grains* of value there may be among the *chaff*, and manfully continue to do its duty to itself, to British Canada, and to the scientific world at large, until it shall have satisfactorily accomplished the indisputably laudable purpose in view;—ever watchfully bearing in recollection that, in the present singularly emulative age, the onward march of mind and enterprise, though fitful, is often found to advance with giant strides, more akin to the sudden movement of the whirling rail-car and the electric wire, than to the slow-paced action of by-gone times—as, witness the late rapid extension of networks of railroads through almost every civilized country, and the long doubtful completion of marine electric telegraphs in addition to those by land—the spanning alike of mighty rivers and yawning chasms with vast, yet airy, ribbon-like, suspension-bridges—the construction of a class of stately yet swift iron clippers, nearly equalling steamers in their speed, and of leviathan screw ships of 10,000, nay 20,000 tons burden, rushing through the waters at the astounding rate of upwards of 400 miles a day—the successful sounding of the great ocean at the depth of more than two miles—and, though last, perhaps not least in influence, the almost simultaneous discovery of gold-regions in different parts of both hemispheres, including even our own youthful favoured land! And therefore, while *Conventions* of learned and scientific delegates from among the chief nations of Europe are being assembled to adopt measures for the universal extension of "the science of Physical Geography," and the completion of a girdle of meteorological observations over the whole ocean, as well as every terrestrial region of the globe,‡ and our energetic and intelligent "go-a-head" American neighbours are being most forward in the noble mental strife, it would little redound to the credit of Canada to be found standing listlessly aloof, with folded arms, while so important a gap in the chain of philoshphic research remains to be filled up at its very door. Let, then, the Canadian Institute, as a leading *British-American* Association, be "up and doing, while it is yet day," bearing in mind the remark of an eminent British soldier and statesman—that he that tries and *fails*, has at least the chances of war to urge in his defence; while he that is content with looking on at a distance and *doing nothing*, only registers thereby his own inefficiency and imbecillity.

* See Canadian Journal, Vol. II., pp. 27, 28, &c.

† See M'Culloch's Geographical Dictionary, Article *Baltic*.

‡ See the able and interesting address of Lieut. Maury, of the American Navy, at the late annual meeting of the New York Geographical and Statistical Society, held on the 10th of February last.

Description of the Platometer, an Instrument for calculating the Area of Figures drawn on Maps. Invented by Mr. John Sang.—With Plate.

The instrument is represented in Fig. 1 of the plate. It consists of a heavy brass frame A, carrying the journals of an arbor, on which are fastened the cone C, and the two rollers BB. The rollers are of equal diameter, so that when they are moved over the map, the frame A is carried forward or backward in a straight line. In the edges of the frame there are cut two grooves, which receive the rims of four friction wheels, two of which, W W, may be seen in the drawing. These friction wheels are journaled in a light frame F, to which the tracing point P is firmly attached; a handle, H, is also attached to the frame F, by means of a universal joint. A third frame, *f*, is connected with F, by means of a centre point hinge, and it carries the journals of an index wheel I, the very narrow edge of which, by means of two springs, is made to press on the cone. There is a ring of silver on the index wheel, divided by lines and figures, which are read off by a vernier and by a reading glass R, both fastened to the frame *f*. The frame *f* is also provided with two screws, the heads of which are shown in the figure (one of them near the letter *f*), giving the means of adjusting the height of the index wheel, so that the line in which it touches

the cone is that line in which a plane parallel to the grooves of the frame A would intersect the cone; and with two binding screws to retain it at that height. The weights of all the parts are so arranged that the tracing point just presses lightly on the map without scratching it.

The effect of this construction is that a slight force applied to to the handle H, which is grasped in the hand like a common pen, may cause the whole instrument to roll along the paper forwards or backwards; or may merely cause the frame F, with the tracing point and index wheel to move sideways to the right or left; or may cause a combination of these motions, so that the tracing point may be guided along any line drawn on the map. When the tracing point is moved to the right or left, the rollers, B B, remaining stationary, the index wheel is merely carried along the edge of the cone without receiving any revolving motion. But when the tracing point is moved forwards or backwards, a forward or backward revolving motion is imparted through the rollers and cone to the index wheel. The ratio of this motion to the forward or backward motion of the tracing point is not uniform, but depends on the diameter of that part of the cone with which the index wheel happens to be in contact, which again depends on the distance from the apex of the cone. If we suppose the index wheel to be at the apex of the cone, and imagine a line to be drawn on the map through the tracing point and perpendicular to the axis of the cone, then as the tracing point and index wheel have the same lateral motion, it is obvious that the revolving motion of the index wheel will be in proportion to the backward or forward motion of the tracing point multiplied by its distance to the left of that line, which we will call the zero line. From this it follows that if the tracing point be guided completely round the boundary of any enclosure, the resulting forward revolving motion of the index wheel will be proportional to the area of that enclosure. This becomes more clear, if we imagine the enclosure to be divided into very narrow sections by lines parallel to the grooves of the frame A, and attend to the effect on the index wheel when the tracer passes over the ends of one of their sections. When the tracer passes over one of the ends, the index wheel revolves forward a distance proportional to the breadth of the section, multiplied by the distance of that end from the zero line; as it continues its journey round the enclosure, it reaches the other end of the narrow section, and in passing over it, the index wheel revolves through a distance proportional to the breadth of the section, multiplied by the distance of that end from the zero line; the motion is, however, now backward with respect to the former, so that the effect with regard to the section is that the index wheel has revolved forward through a space proportional to the difference between the distances of the ends of the section from the zero line (that is to say, the length of the section), multiplied by its breadth, which is the area of the section. And as the same thing happens with regard to each of the sections, into which we have conceived the enclosure to be divided, it follows that when the tracer has made a complete circuit, the sum of the forward and backward revolving motion of the index wheel is a forward motion proportional to the whole area of the enclosure.

This happens with regard to every enclosure, whatever its shape or however irregular its outline, so that in calculating an area by means of the instrument, we have only to make a small mark with the tracer on the outline, observe the reading of the index wheel, lead the tracer along the boundary of the enclosure till it again reaches the small mark, and again observe the reading of the index. The difference of the two readings is the area. In practice it has been found convenient to make the readings give square inches, tenths, and hundredth part of square inches. In the instrument represented in Fig. 1, a complete revolution of the wheel indicates 20 square inches, and in order to carry on the indications as far as 100 inches, a second toothed wheel T, is placed so as to receive motion from a pinion on the arbor of I. In manufacturing the instruments, the diameters of the index wheels are adjusted so that the divisions may accurately indicate square inches, by trying them frequently on the outline of an oblong figure of about 100 square inches engraved on a copper plate. The diameter of the wheels are slightly lessened at each trial, until at length they indicate precisely the area which had previously been ascertained by means of very accurate measurements with a standard scale under a microscope, to be that of the figure engraved on the copper. They are then ready to indicate in standard square inches the area of any other figure.

It is found that in passing the tracer over lines oblique to the machine, there is a slight retardation of the index wheel, so that the reading is a very little more or less than the true area, depending on the position in which the figure is presented to the instrument. This retardation is very small, and practically it is destroyed by turning the figure half round, and again tracing it and noting the area. The effect of the retardation is now equal, and contrary to that in the first tracing, and the average of the two is the true area; and this result was found on experiment to be a little more accurate than the results of very careful measurements made by scales and calculations in the ordinary manner. As a practical test of the value of the Platometer in this respect, an enclosure of an estate plan was measured very carefully by scale and calculations. It was then re-measured. The small difference between the two results was an indication of the degree of accuracy obtained. The same enclosure was then measured twice by the Platometer, and the difference between its results being in like manner an indication of their degree of accuracy, a comparison between the two differences gave the means of judging of the accuracy of the two methods. In an experiment made on a single enclosure, it happens sometimes that this indication is in favour of the scale, and sometimes in favour of the instrument; but the aggregate indications of a number of experiments was always found to be in favour of the instrument. Thus, in an estate plan containing 90 enclosures, each enclosure being measured separately, there was found:

	By Scale.		By Platometer.
Sum of the means of each pair	740·92	...	741·01
Sum of the differences	2·79	...	2·44
Greatest difference...............	·17	...	·09
Least difference..................	·00	...	·00

This aggregate is in favour of the Platometer as 279 is to 244.

Many trials of this nature having completely shown the trustworthiness of the Platometer, and it being of great value in respect to the saving of time, experimental alterations were made in its form, with the view chiefly of doing away altogether with the retardation of the index wheel in passing over oblique lines. One of them is represented in Fig. 2. In this the rollers, B B, are lessened in diameter; and in order to make the lessening possible they are raised up on another pair of rollers, G G, instead of coming in contact with the map. As the space representing a square inch on the index wheel is inversely as the diameter of the rollers, by this means the divisions were increased in size, so that they read thousandths instead of hundredth parts of an inch. It was not found that advantages commensurate with the increased expense of the machine were obtained from this form.

But in the course of experiments it was discovered that the slight retardation was lessened, and for practical purposes obviated, by giving a certain proportion to the breadth of the edge of the index wheel and the tension of the springs (1-100th inch to 13 ounces). A construction, only differing from that of Fig. 1 in some details, was therefore adopted. This is represented in the woodcut, Fig. 3. In it the second toothed index wheel is dispensed with, the single index wheel being increased in diameter so as to read to 50 square inches, and in place of four there are only three friction rollers. Instruments of this description have an accuracy amply sufficient for all practical purposes, about double what has been noted above, and are of great value in measuring enclosures on maps, especially those which have very irregular wavy outlines, effecting both an increase of accuracy and a great saving of labour and time over the old methods.

Process for Printing copies of Plants, Materials, Lace, &c., from the originals, styled ("Naturselbstdruck") Natural Printing Process.

Under this term, Louis Auer, of the Imperial Printing Office at Vienna, has patented a process invented by himself in conjunction with Mr. Andrew Worring, overseer of the same establishment, "for creating, by means of the original itself, in a swift and simple manner, plates for printing copies of plants, materials, lace, embroideries, originals or copies, containing the most delicate profundities or elevations not to be detected by the human eye," &c. A pamphlet giving a description of this discovery and a series of specimens has reached us. The examples consist of an impression from a fossil fish, from agates, the leaves of trees, several plants, mosses, algæ, and the wing of a bat. These are all printed in the natural color of the objects they represent; and it is difficult to conceive anything more real than these productions. The general character of the process is told in the following pithy manner by Louis Auer, in the introductory paragraphs of his pamphlet:—

"*Query*—How can, in a few seconds, and almost without cost, a plate for printing be obtained from any original, bearing a striking resemblance to it in every particular, without the aid of an engraver, designer, &c.?—*Solution*—If the original be a plant, a flower, or an insect, a texture, or, in short, any lifeless object whatever, it is passed between a copper plate and a lead plate, through two rollers that are closely screwed together. The original, by means of the pressure, leaves its image impressed with all its peculiar delicacies,—with its whole surface, as it were,—on the lead plate. If the colors are applied to this stamped lead plate, as in printing a copperplate, a copy in the most varying colors, bearing a striking resemblance to the original, is obtained by means of *one single* impression of each plate. If a great number of copies are required, which the lead-form, on account of its softness, is not capable of furnishing, it is stereotyped, in case of being printed at a typographical press, or galvanized in case of being worked at a copperplate press, as many times as necessary, and the impressions are taken from the stereotyped or galvanized plate instead of from the lead plate. When a copy of a unique object, which cannot be subjected to pressure, is to be made, the original must be covered with dissolved gutta percha; which form of gutta percha, when removed from the original, is covered with a solution of silver to render it available for a matrix for galvanic multiplication."

This process is also applicable to the purpose of obtaining impressions of fossils, or of the structure of an agate or other stone. In all the varieties of agate, the various layers have different degress of hardness; therefore, if we take a section of an agate, and expose it to the action of fluoric acid, some parts are corroded, and others not. If ink is at once applied, very beautiful impressions can be at once obtained; but for printing any number, electrotype copies are obtained. These will have precisely the character of an etched plate, and are printed from in the ordinary manner. The silicious portions of fossil and the stone in which they are imbedded may in like manner be acted upon by acid; and from these either stereotyped or electrotyped copies are obtained for printing from. We learn that Mr. Bradbury, of the firm of Bradbury and Evans, has availed himself of this invention, and that he is now preparing a series of Botanical specimens for publication,—so that, very shortly, the public will be in possession of examples of this beautiful process. It is not a little singular that the workers in German silver and Britannia metal, at Birmingham, have for some time been in the habit of ornamenting the surfaces of these metals by placing a piece of lace, no matter how delicate, between two plates, and passing these between rollers. In this way every fibre is most faithfully impressed upon the metal. We are not aware, however, that any attempts to print from these impressions have yet been made at Birmingham. The value set on the invention by the author may be judged by the following paragraph:—

"Russia has given up Jacobi's application of the Galvanoplastic in the year 1837, and France the Daguerreotype for general use in the year 1839; Austria has now furnished a worthy pendant to these two inventions."

On the Consumption of Smoke.—Experiments with Jukes's Patent Furnace. By Mr. A. Fraser.*

The author stated that it was not intended to enter on the various theories which have been advanced on the subject; or to discuss the many inventions before the public, still less to bring forward any new theory, but to give the "results of absolute work," in a successful attempt to remove the smoke nuisance from an extensive London brewery and its neighbourhood. Messrs. Truman, Hanbury, Buxton & Co. had tried most of the plans which previous to 1847 gave reasonable hopes of success. In 1847 the writer's attention was first drawn to Jukes's patent furnace, which consisted of a strong cast-iron frame of the full width of the furnace, and about three feet longer. The fire bars were all connected together, forming, when complete, an endless chain, and were made to revolve round a drum, placed at each end of the frame. The front of the frame was provided with a hopper, in which the fuel was placed, and a furnace door, which opened vertically with a worm and pinion. The height to which the door was raised by the stoker, regulates the supply of coal, which was carried into the fire by the gradual motion of the bars. This plan was first applied to an engine boiler—a cylindrical one, with two tubes—driving a 40-horse power engine; and having been successful, it was adapted

* See page 310. † Erom the London Athenæum.

* From the London Athenæum.

to a second boiler of the same kind. In the same year the probability of its success under a brewing copper was discussed. There was no doubt, from the former experiments, as to its capabilities for raising steam or for evaporation; but with a brewing copper provision had to be made for a process in the manufacture almost peculiar to it. The contents of the copper have to be turned out several times in the course of a brewing, rendering it necessary to "bank up" the fire thoroughly, to protect the bottom of the copper, until refilled with wort or water. It was feared that the machinery would interfere with this being done effectually: it was tried, and with the same success as with the steam boilers. The remainder of the coppers and boilers were afterwards altered. The total cost of the fourteen furnaces, including brickwork, had been about £3000. The consumption of coals in the establishment was 6000 tons per annum. The saving in the coal account, since the introduction of the patent to July 1st of the present year, had been £8338, from which must be deducted for casualities, and sundries, say £350. The above economy had not arisen from less weight of fuel consumed, but owing to the screenings or dust of coal only being required for the furnaces. It would appear at first sight that the wear and tear of a machine, apparently so complicated, must exceed the expense of the common fixed bars. This, however, had not been found to be the case, and it need not be so if ordinary care were given to the machine, and a periodical examination such as any other machine of equal value and producing equally important results would receive. Within the last week a set of bars, which had been in use since May, 1849, had been renewed, for the first time; and three-fourths of the old bars were being again used for another furnace, where the boiler was of less importance than the one from which they have been removed.

On preserving the Balance between the Animal and Vegetable Organisms in Sea Water.

BY ROBERT WARINGTON.*

In the published notices of my experiments of 1849, to maintain the balance between the animal and vegetable organisms in a confined and limited portion of water, the fact was demonstrated, that, in consequence of the natural decay of the vegetation, its subsequent decomposition and the mucus-growth to which it gave rise, this balance could be sustained only for a very short period, but if another member were introduced, which would feed upon the decaying vegetation and thus prevent the accumulation of these destructive products—a function most admirably performed by the various species of water-snail—such balance was capable of being continuously maintained without the slightest difficulty; and I may add, that the experimental proof of this has now been carried on, in a small tank in the heart of London, for the last four years and a half, without any change or disturbance of the water; the loss which takes place by evaporation being made up by rain or distilled water, so as to avoid any great increase of the mineral ingredients originally present. It follows then, as a natural deduction, from the successful demonstration of these premises, that the same balance should be capable of being established, under analogous circumstance, in sea water. And in a paper published in January, 1852,† I stated that I was, at that time, "attempting the same kind of arrangement with a confined portion of sea water, employing some of the green sea-weeds for the vegetable member of the circle, and the common periwinkle as the representative of the water-snail."

The sea water with which the experiments I am about to detail were conducted, was obtained through the medium of one of the oyster-boats at the Billingsgate fish-market, and was taken from the middle of the English Channel.

My first object was to ascertain the kind of sea-weed best fitted, under ordinary circumstances, for keeping the water clear and sweet, and in a sufficiently oxygenated state to sustain animal life. And here opinions were at variance, for one naturalist friend whom I consulted, advised me to employ the Rhodosperms; another stated that it was impossible to make the red weeds answer the purpose, as he had tried them, and strongly recommended the olive or brown colored Algæ; while, again, others thought that I should be more successful with those which had in theory first suggested themselves to my own mind, namely the Chlorosperms. After making numerous unsuccessful experiments with both the brown and red varieties of Algæ, I was fully convinced that, under ordinary circumstances, the green weeds were the best adapted for the purpose.

This point having been practically ascertained, and some good pieces of the *Enteromorpha* and *Ulva latissima* in a healthy state, attached to nodules of flint or chalk, having been procured from the shore near Broadstairs, several living animal subjects were introduced, together with the periwinkle. Everything progressed satisfactorily, and these all continued in a healthy and lively condition.

My first trials were conducted in one of the small tanks which had been used for fresh water; but as it was necessary, during the unsuccessful experiments with the brown and red sea-weeds, to agitate and aerate the water, which had been rendered foul from the quantity of mucus or gelatinous matter generated during the decay of their fronds, until the whole had become oxydized, and the water rendered clear and fitted for another experiment, it was, therefore, for greater convenience, removed into a shallow earthern pan and covered with a large glass shade to protect the surface of the water, as much as possible, from the dust and soot of the London atmosphere, and at the same time impede the evaporation. In this vessel then I had succeeded perfectly in keeping a large number of beautiful living specimens in a healthy condition up to the close of 1852. I therefore gave instructions for the making of a small tank, as a more permanent reservoir, and one more adapted for carrying on my observations and investigations on the economy and habits of the inhabitants.

From the experience I had obtained in my experiments with the freshwater tank, I was induced to modify slightly the construction of this vessel; thus, at the back, or part towards the light, the framing was filled with slate in the same way as the ends and bottom; for I had found that the glass originally employed, very soon became covered with a confervoid growth which had an unpleasing appearance to the eye, and in consequence of which I had been obliged to paint the glass on the exterior, to prevent this growth from increasing to too great an extent. It was also an unnatural mode of illumination, as all the light should pass through the surface of the water. The

* Communicated to the *Athenæum* by the Author, having been read at the Hull Meeting of the British Association.

† Gardeners' Botanical Magazine and Garden Companion, January, 1852.

front towards the room and the observer was constructed of plate-glass, the whole being set in a stout framework of zinc, and cemented with what is known under the name of Scott's cement, and which I have found to answer the purpose most admirably. Within this tank were arranged several large pieces of rock-work, thrown into an arched form, and other fragments were cemented in places against the slate at the back and ends, and at parts along the water line, so that the creatures could hide themselves at pleasure; a short beach of pebbles was also constructed in order that shallow water could be resorted to if desired. The whole tank was covered with a light glass shade to keep out the dust and retard evaporarion.

With the sea water obtained in January, 1852, I have been working without cessation up to the present time, agitating and aerating when it became foul during the unsuccessful experiments on the sea-weeds, but since then it has been rarely ever disturbed; the loss which takes place from evaporation being made up, as before stated, with rain or distilled water.

For a considerable period, after commencing these experiments, I was much troubled to obtain living subjects in a healthy condition, but having alluded to this, and the success of my investigations, in a short notice appended to a paper published in the "Annals of Natural History" for October, 1852, my friend, Mr. P. H. Gosse, who was then sojourning at Ilfracombe for his health, offered in the kindest manner to supply me with materials, and from that period he has always most heartily responded to my wants. It must not be imagined for a moment that the beautiful creatures I have thus received have all been preserved alive or always quite healthy. In experimental investigations this would be unreasonable to expect, as the very fact of experimenting implies a disturbance of the then state of things. Besides which, from want of a sufficient knowledge of natural history, from want of forethought and experience, and other causes, I have lost many very fine specimens; and as the detail of these losses may prevent the occurrence of the like annoyances to others, I shall venture to occupy your time for a short period with their history.

My greatest loss arose from too great anxiety to transfer the collection I had preserved in healthy condition to the end of December, 1852, into the new tank. As soon as it arrived from the maker's I lost no time in introducing my numerous family to their new abode, and dearly I paid for my precipitancy, for on the next morning I found many of my most beautiful specimens dead; thus I lost two fine Holothurias (*H. Pentactes*), a small freckled Goby (*Gobius minutus*), a beautiful little Pipe-fish (*Syngnathus lumbriciformis*), and several others, and on opening the door of the case the cause of this mortality was at once evident,—an iridescent film of oily matter was floating on the surface of the water, arising from the paint with which the angular joints and edges of the small tank had been colored not having become sufficiently hardened.

Another source of loss arises from the several creatures attacking and devouring each other, and therefore it becomes a point of great importance—and highly necessary to be carefully observed, where their preservation is an object—to ascertain what varieties may be safely associated in the same tank; as, for instance, I have found that the Shrimps, and Prawns attack, and very soon devour, all the larger varieties of Corallines and Polyps, Sabellæ, Serpulæ, Rock-bores, Cirrhipeds, some of the Annelids, many of Bivalve and Univalve Mollusks that are unprotected by an operculum, or have no power of closing their valves. The instances which have come under my own immediate observation have been the destruction of the *Pholas dactylus*, *Saxicava rugosa*, *Cypræa Eruopæa*, and several specimens of Sabellæ, Serpulæ, *Coryne sessilis* and many others.

The common Crab (*Cancer Manæs*) is likewise a most destructive agent; and the tribe of rock-fish, the Blennies, Gobies, &c., are also most voracious, devouring all the varieties of Cirrhipeds, Corallines, Polyps, Annelids, &c.; they will also also attack the shrimps and prawns, and even seize upon the horns of the periwinkle, which they bite. If the mollusks do not keep a very firm hold of the rock or tank sides, they are rapibly turned over by these fish on their backs and lie helplessly exposed to their attacks.* It is doubtless their seeking food of this kind which causes these little fish to be so generally found in the shallow rock-pools of the coast, in consequence of these ravenous propensities I have been obliged to establish several small tanks, and imitation rock-pools, so as to separate these various depredators from each other: thus in one I have varieties of *Actinia*, Shrimps, Nudibranchs, Holothurias, and some Annelids; in a second the rock-fish, as the Blennies, Gobies, Cottus, with Crabs and *Actiniæ;* in a third Corallines, Annelids, Polyps, Rock-borers, Sabellæ, Serpulæ, Holothurias, and *Actiniæ*.

Another curious instance of loss I may detail which has quite recently occurred, and which may prove interesting; it was in a small rock-pool containing Blennies, Gobies, Crabs, &c. I had procured two live oysters for the purpose of feeding my numerous small fry in these Vivaria, and one of these having proved ample for the purpose of one meal, the other was placed on the sandy bottom; on the second day after this, the oyster was observed to have opened the valves of his shell to a great extent, which were afterwards seen closed, but a small *Gobius Niger*, inhabiting the pool, could no where be seen. The day after this the oyster was opened for the general feeding, when lo! within the shell was found the unfortunate *Gobius*, quite dead. Whether this little gentlemen had been attracted within the trap by curiosity or the ciliary motion of the oyster, it is impossible with certainty to say; but that he must have seized on some sensitive part of the oyster is more than probable, so as to have caused such a rapid closing of the shell as could entrap so active a burglar.

Another important point is the gravity of the sea water; this should be very carefully regulated, for it must be borne in mind that many of the marine creatures are supplied by a permeation of water through their tissues or over their delicate and beautiful organs. The specific gravity should not rise above 1026 at 60° Fahr., and a small hydrometer should be introduced at short periods to ascertain that this point is not exceeded, particularly during the hot months of summer. The reduction to this gravity can be readily effected by the addition of rain or distilled water. Many of the creatures will of themselves afford

* Since the reading of this paper at Hull I have received a Blenny of larger size, being about $3\frac{1}{2}$ inches in length, and although it has become so tame that it will allow itself to be touched by the hand and takes its food from the fingers, yet its destructive propensities are so great, that it very soon killed four small Crabs; and to save three others of rather a larger size, I have been obliged to remove the Blenny to a rock-pool in association with his own species and a few *Actiniæ*. The only refuge the poor Crabs had was to bury themselves in the sand, and whenever they attempted to move out of their refuge they were immediately pounced upon and only escaped by burrowing rapidly again.

indications of this increase of destiny; some of the *Actiniæ* will remain closed and become coated with a white slimy covering within which they remain for a length of time, and if the specific gravity of the water be lowered this is very soon ruptured by their expansion, thrown off, and the tentacula become soon extended.

All putrescent matter or excess of food or rejecta of the *Actiniæ* should be carefully removed from the water, as the noxious gaseous compounds generated by the decay of such matters appear to diffuse themselves rapidly through the water, act as a virulent poison, and speedily destroy the vitality of the occupants. Thus many beautiful subjects were lost in a few hours from the introduction, into a small glass jar of a large Pecten shell, encrusted with corallines, which had become loaded with putrescent matter by a partial submersion in a foul muddy bottom.

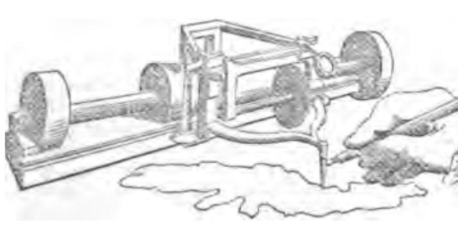
Great care should also be taken in moving the *Actiniæ*, that the foot or sucking disc with which it attaches itself to the rocks, stones, or mud, be not injured, as, when this occurs, they rarely survive, but roll about without attaching themselves, and gradually waste away and die.

With these exceptions then, everything has gone on very satisfactorily, care being always taken not to overload the water with too large a proportion of animal life for the vegetation to balance, as whenever this has been inadvertently attempted, the water has soon become foul, and the whole contents of the tank, both animal and vegetable, have rapidly suffered, and it has required some time before the water could be restored to its former healthy condition.

In one of the numbers of the "Zoologist" of last year, I stated that besides the *Ulvæ*, *Enteromorphæ*, and *Cladophoræ*, I had found the *Zostera marina* a very useful plant for oxygenating the sea water; but this observation has reference only to the case of a tank supplied with a ground where its roots will find a sufficiency of food for its growth, as in a clear shingle or sand it soon decays; and it should be associated with such animals as delight in a ground of this nature, as many of the Annelids, Crabs, burrowing Shrimps, &c. There are several interesting observations which have been made from time to time connected with this subject, which I hope to lay before the natural-history world as soon as I can find leisure time for the purpose.

Sang's Platometer, or Self-acting Calculator of Surface.

In this number we publish a description (see page 305), accompanied with plate, of an exceedingly ingenious instrument



for computing the areas of irregular figures. One of these instruments has recently been imported from England for the service of an engineering establishment in town, and we have been favoured with an opportunity of examining its mechanism and testing its accuracy.

By the usual and well known method of dividing the figure to be measured into a number of triangles or trapeziums, carefully ascertaining the base and altitude of each, and taking the sums of the products, the area may be discovered with great accuracy; but as it is necessary to revise the calculations several times, both for the purpose of obviating fault in the arithmetical part of the work, and in order, by taking the average of a few independent measurements, to increase the probable accuracy of the result, this method of calculation, especially when the figure is irregular, entails a considerable amount of labour of an irksome kind. Attempts have been made to avoid this by cutting the figure from the sheet of paper, and weighing it in a delicate balance against weights, consisting of part of the same paper of determinate sizes; but this method—at first sight simple and practical—is rendered of little use by the impossibility of obtaining paper of uniform thickness throughout the sheets, the variations of thickness, and hence of weight, being greater than the amount of error that could be allowed in the results.

The platometer indicates the area of any figure, however irregular, on merely carrying the point of a tracer round its boundary; and, besides the advantage of not injuring the drawing, it possesses that of speed and accuracy.

From the peculiar construction of the instrument, it is apparent that if the tracer be moved forward, it will cause the index to revolve, not simply in proportion to that motion, but in proportion to the motion of the tracer multiplied by the distance of the edge of the index wheel from the apex of the cone; and that the revolving motion of the index wheel will be positive or negative, according as the tracer is carried backwards or forwards. Hence, if the tracer be carried completely round the outline of any figure—on arriving at the end of its journey, the index wheel will show the algebraic sum of the breadth of the figure at every point, multiplied by the increment of the distance of the points from the apex of the cone; that is to say, the area of the figure.

As pointed out in the general description of the instrument, the exact amount of any errors which may arise from imperfections in mechanism or adjustment can easily be discovered, by simply reversing the paper and moving the tracer a second time over the boundary of the figure; if the results of both trials be alike there can be no error; but if they vary [the errors in one case being positive, and in the other negative], an average between the two is the exact area of the figure, and is more to be depended on than the results of measurements made by scale and calculation in the usual way. A careful operator, in using the platometer, will always take the average of two tracings as described; but when he experiences the rapidity with which this may be done, he will find the trouble as nothing in comparison with the harassing labour of calculating by scale and multiplication.

Sang's Platometer, like most other really valuable inventions, possesses great simplicity of construction, and is not liable to get out of order with ordinary care.

It can be ordered from the inventor through Messrs. Hearn & Potter, mathematical instrument makers, Toronto.

The Greenwich Observatory.*

The Annual Visitation of the Royal Observatory took place on Saturday last, when the Board of Visitors inspected this national establishment. The Astronomer Royal, in his Report, states that he trusts to be able to report at a very early date, the conclusion of the very important operation of determining the longitude difference between the observatories of Greenwich and Paris.

In his last report, Mr. Airy alluded to the erection of a time signal ball at Deal, to be dropped every day by a galvanic current from the Royal Observatory. The ball has now been erected by Messrs. Maudslay & Field, and the galvanic connexion with the Observatory, through the telegraph wires of the South Eastern Railway, is perfect. The automatic changes of wire communications are so arranged that, when the ball at Deal has dropped to its lowest point, it sends a signal to Greenwich to acquaint Mr. Airy, not with the time of the beginning of its fall (which cannot be in error), but with the fact that it really has fallen. The ball has several times been dropped experimentally with perfect success, and some small official and subsidiary arrangements alone are wanting for bringing it into constant use.

No step has yet been taken for the galvanic determination of the longitude of the Oxford Observatory, but the necessary preparations within that building are now complete.

The normal clock, with its small adjusting apparatus, has been in constant use. It drops the Greenwich ball and the Strand ball; it sends daily signals along several railways, and it maintains in sympathetic movements various clocks by galvanic currents. Among other clocks thus moved, one is in the chronometer-room, one at the Observatory entrance gate, and one at the South-Eastern Railway offices, London Bridge.

The barrel apparatus for the American method of transits, has been practically brought into use, not, however, as Mr. Airy states, without having met with a succession of difficulties which happily have been overcome. Still Mr. Airy considers the apparatus troublesome, consuming much time in the galvanic preparations and other details. But its high astronomical merits of general accuracy render the method very far superior to the former mode of observing by the eye and ear.

The beautiful system of registering magnetical and meteorological changes by means of photography continues to be employed, and efforts have been made to multiply copies of the Photographic Registers. After many experiments, it was found that, by the agency of sunlight upon the back of an original photograph, whose face was pressed closely, by means of a glass plate, upon proper photographic paper below, there would be no difficulty in preparing negative and inverted secondaries, and, from them, positive tertiaries. Thus, beyond the trouble which the process involves, Mr. Airy anticipates that it will be easy to multiply copies to any extent which may be desired.

The changes among the Observatory instruments have been so trifling during the past year as not to require definite notice. A fire-proof room, for the preservation of valuable documents will shortly be constructed, a sum having been granted by the Admiralty for that purpose.

Under the head of "General Remarks," the Astronomer Royal thus concludes his Report:—"The past year has, on the whole, been felt as a laborious one. This has arisen from accumulation of several perfectly distinct causes. The order of our printing has been disturbed, and this has produced great disarrangement of all our ordinary daily work. The establishment of our galvanic system, and its application to American transits, to public time-signals, and more especially to the longitude determination, has caused to the establishment in general, and to myself in particular, a great consumption of time. The preparation of the Observatory Regulations, and of the description of the Transit-Circle, and the closing of the business of the Standard Commission, have required a great amount of writing which could be entrusted to no one but myself. I may confidently hope that in the next following years several of these causes will not be in action. Still I am impressed with the feeling that the strength of our establishment is now loaded to the utmost that it can bear. A brief review of the progress of the science of Astronomy and of the arts related to it will show that this must be expected. The number of known planets has been largely increased: and I cannot think that in this National Observatory the neglect of any one of the bodies of the Solar System is permissible. The American method of transits adds to our labours; but it appears likely to contribute to accuracy, and it will give facilities for the record of the observations made at other Observatories, upon our registering barrels; and if these advantages are established by experience, the method must be maintained. The public dissemination of accurate time brings some trouble; but it is a utilitarian application of the powers of the Observatory so important that it must be continued. The galvanic determination of difference of longitude brings with it a mass of work in negotiations, in preparations, and in calculations; but it produces results of such unimpeachable excellence, and of such value to astronomy and geodesy, that it must in anywise be preserved as part of our system. Time is consumed in experiments for the improvement of our photographic process, and in measures for the multiplication of copies; but these are worthy objects of attention, which it would be wrong to neglect. All these are additions to the labours of the Observatory as they existed a few years ago, unbalanced by any corresponding subtraction."

* *Athenæum.*

Notices of Books.

THE BOOK OF NATURE, an elementary introduction to the Sciences of PHYSICS, ASTRONOMY, CHEMISTRY, MINERALOGY, GEOLOGY, BOTANY, ZOOLOGY, and PHYSIOLOGY, by FRIEDRICH SHOEDLER, PH. D.; translated from the Sixth German Edition, by HENRY MEDLOCK, F.C.S.; illustrated by 679 engravings on wood—pp. 691, 8vo; Philadelphia, Blanchard and Lea, 1853.

A very complete and exact popular exposition of Natural Science; well printed, well illustrated, and supplied with a valuable and copious glossary of Scientific terms. The Book of Nature has met with an extensive circulation in Germany and England, and is not only well suited to the higher schools, but is particularly to be recommended to that numerous class whose occupations do not permit them to devote a large share of their time to books. We can imagine no better companion for the winter evening study of intelligent farmers, and none which will be so constantly furnished with practical lessons and examples in their daily walk of life.

THE ANGLO-AMERICAN MAGAZINE—Maclear & Co., Toronto.

The first number of the fifth volume of this well-sustained publication appears in a new dress. The change is a very decided improvement, and augurs well for the success of the enterprising publishers. The engraving of the Cedar Rapids is admirably executed. We are both encouraged and pleased at witnessing so marked a progress.

PHYSICAL GEOGRAPHY, *by* MARY SOMERVILLE; *American Edition by* W. S. W. RUSCHENBERGER, M.D.—Philadelphia; Blanchard and Lea, 1854.

The accomplished Author of the Connexion of the Physical Sciences has sufficiently indicated the importance and scope of Physical Geography in the first paragraph of the work before us. "Physical Geography is a description of the earth, the sea, and the air, with their inhabitants, animal and vegetable, of the distribution of these organized beings, and the causes of that distribution."

As a general view of the earth with its inhabitants, Mrs. Somerville's Physical Geography has acquired a wide and well deserved reputation. It will, however, be very easily understood that in a so comprehensive a work many inaccuracies occur in the first edition which are not expected to appear in the second or third. It is even more reasonable to suppose that an American edition, professedly well supplied with notes and emendations by its American editor, would be especially precise and exact in the physical geography of this continent.

Anxious to ascertain how far the "New American from the third and revised London edition," kept pace with modern discoveries and knowledge of facts within the ken of every college boy in the United States and Canada, we bestowed particular attention upon those portions of the work which described the region of the Great Lakes—naturally supposing that Dr. Ruschenberger would also have given *his* attention to this part of the work. On page 264 we find the following:—

"The American lakes contain more than half the amount of fresh water on the globe. The altitude of these lakes shows the slope of the continent: the absolute elevation of Lake Superior is 672 feet; Lake Huron is 30 feet lower; Lake Erie 32 feet lower than the Huron, and Lake Ontario is 331 feet below the level of Erie. The river Niagara, which unites the two last lakes, is 33½ miles long, *and in that distance* it descends 66 feet; it falls in rapids through 55 feet of that height in the last half mile, but the upper part of its course is navigable. The height of the Cascade at Niagara is 162 feet on the American side of the central island, and 1,125 feet wide—on the Canadian side the fall is 149 feet high, and 2,100 feet wide—the most magnificent sheet of falling water known, though many are higher. The river St. Lawrence which drains the whole, slopes 234 feet between the bottom of the cascade and the sea."—(*Page* 264.)

The sum of the differences between the levels of Lake Ontario and Superior would give, according to the above statement, 393 feet, which subtracted from 672 feet, the altitude of Lake Superior above the sea, gives 279 feet for the height of Lake Ontario above tide level—whereas a few lines lower down the true altitude of 234 feet is given.

Every Canadian familiar with the majestic scenery of the Falls of Niagara will recognize the misconception which is apparent in the quotation given above, and which the American Editor should not have overlooked. The introduction of a few words will render the passage clear, and remove the arithmetical absurdity which also exists in the numbers given, and their sum. The descents in the Niagara river are as follows:—

Black Rock to head of Rapids	15 feet.
Rapids to Cascade	52 ,,
Cascade	160 ,,
Cascade to Lewiston,	104 ,,
	331 feet.

The description of the Forests of Canada is decidedly novel. They consist chiefly of "black and white Spruce." We give the author's own words:—

"The Canadas contain millions of acres of good soil, covered with immense forests. Upper Canada is the most fertile, and in many respects is one of the most valuable of the British Colonies in the west: every European grain, and every plant that requires a hot summer, and can endure a cold winter, thrives there. The forest consists chiefly of black and white spruce, the Weymouth and other pines—trees which do not admit of undergrowth: they grow to great height, like bare spars, with a tufted crown, casting a deep gloom below. The fall of large trees from age is a common occcurrence, and not without danger, as it often causes the destruction of those adjacent; and an ice storm is awful."—(*Page* 128.)

The passage given above is modified in other portions of the "Physical Geography," but, perhaps, not in a manner which will suit the ideas Canadians are accustomed to form of their own magnificent forests. On page 364 we find the following:—

"Boundless forests of black and white spruce, with an undergrowth of reindeer moss, cover the country south of the arctic region, which are afterwards mixed with other trees; gooseberries, strawberries, currants, and some other plants thrive there. There are vast forests in Canada of pines, oak, ash, hickory, red beech, birch, the lofty Canadian poplar, sometimes 100 feet high, and 36 feet in circumference, and sugar-maple; the prevailing plants are Kalmias, Azaleas, and Asters, the former vernal, the latter autumnal; Solidagos and Asters are the most characteristic plants of this region.

"The splendour of the North American flora is displayed in the United States; the American Sycamore, chesnut, black walnut, hickory, white cedar, wild cherry, red birch, locust-tree, tulip-tree, or liriodendron, the glory of American forests; liquid-ambar, oak, ash, pine-trees of many species, grow luxuriantly, with an undergrowth of Rhododendrons, Azaleas, Andromedas, Geradias, Calycanthus, Hydrangea, and many more of woody texture, with an infinite variety of herbaceous and climbing plants."

A little more attention to the Physical Geography of this continent on the part of the American Editor, in several other instances which we could point out, would have rendered this valuable and instructive work doubly interesting to the Canadian reader..

Miscellaneous Intelligence.

ON THE GLUTEN OF WHEAT.—M. Millon, compelled by his high military position to rather a nomadic life, has for some years suspended the fine researches which he had undertaken—researches on the oxydized compounds of nitrogen, chlorine, mercury, nitric ether, also on vegetable physiology, etc., which had given him a high rank among men of science. Removed from his laboratory and sent to Africa, for political reasons, he has found the means of carrying on some important investigations without a chemical laboratory, and he has just now brought before the Academy a series of papers which he proposes to present, containing the results of some researches on wheat.

In his first memoir, he brings out the important fact that there are some kinds of wheat, of good appearance, *that contain no gluten.* His attention was called to the subject by the wheat of Guyotville (Algeria), which although appearing well, was nearly destitute of this important ingredient. He was thus led to examine a quantity of the wheat poor in gluten, and he found it to be a mixture of rich grains with others containing none of this albuminoid substance. Dough made from the wheat of Guyotville without gluten is worked with more difficulty than ordinary dough, and the bread is swallowed with some difficulty, like that which is dry or stale. The nitrogenized substance of this wheat is soluble in water.

In a second memoir, M. Millon takes up the chemical composition of different varieties of wheat, and he deduces from his results a distribution of the wheats—using terms already in use—into *tender wheat,* and *hard wheat,* the characters of which are as follows:—

Tender Wheat,—Fracture white, opaque, farinaceous, the starch and escaping more or less abundantly; a more or less complete replacement of

the gluten by a soluble albuminoid principle varying widely in the proportion of nitrogen.

Hard Wheat,—Fracture horny, semi-translucent, without a starch-like appearance; all the nitrogen existing under the form of gluten and the weight of it always a little superior to the quantity of albuminoid principal represented by the nitrogen; only small variations in the proportion of nitrogen, the amount of which is large. This last characteristic does not serve to distinguish the hard wheat, since it is not rare to meet with tender wheat containing as much nitrogen as the hard wheat, or even more.

Wheat intermediate between these two varieties, M. Millon names *semi-hard* wheat, which he describes as follows:—

Fracture close and less horny than in hard wheat; whitish when crushed; a proportion of gluten mixed with the albuminoid principle; a large proportion of nitrogen, and this nearly constant.

These descriptions are completed by a mention of the external characters, taken from the volume, color, integuments, etc. His facts are derived mainly from the wheat of Algeria and those of the north of France, and it remains to make the results general, and applicable to wheat of whatever origin.—*Correspondence of Silliman's Journal.*

On the Proximate Principles of Bran of Wheat.—Some years since, M. Millon, as a result of long labor, arrived at the conclusion that bran is an alimentary substance; that bran bread and pilot bread ("pain de munition") was more healthy and more nutritious than white bread. This opinion has been contested, and Millon has been ironically attacked for not conforming to the regimen he recommends. But the opinion is now sustained by Chevreul, who declared his views on the occasion of a memoir of M. Mourier on this subject. It is known too that according to Magendie's experiment, dogs could live on bran bread whilst they died on white bread. This fact which appeared so singular, is explained through the researches in question.

The inner surface of bran is covered with azotized principles which like diastase will dissolve starch, changing it into dextrine and sugar. These principle differ somewhat from diastase; still it is demonstrated that the bran acts as a ferment in fermentation, and consequently in a similar manner in digestion.

On forming Vessels of Gold by the aid of Phosphorus.—The property of phosphorus, of precipitating certain metals from their solution has long been known; and gold is among the number. M. Levol has used this process in forming gold vessels useful in chemical research. He takes the perchlorid of gold, and places in it, at the ordinary temperature, some phosphorus, moulded of a form convenient to serve as a nucleus for the vessels of gold. To give the phosphorus the desired shape, it is melted in a water bath near 60° C. in temperature, within a vessel of glass having the form required. After cooling it, the phosphorus is taken out solid, from its envelop, breaking it, if it be necessary. The precipitation of the gold or the construction of the vessel is then begun; and it finally remains only to remove the phosphorous by remelting it and washing by the aid of boiling nitric acid until the last traces are removed.

New Planets:—*Bellona* (28), (Comptes Rend., xxxviii, 455, 561).—On the first of March, 1854, Mr. Luther, Director of the Observatory at Bilk, discovered a new planet, which has received from Mr. Encke the name *Bellona*: it is of the tenth magnitude. Its position, March 6d 10h 27m 30s, M. T. Hamburg was R. A. 180° 35′ 38″ and Dec. + 7° 47′ 34″. Mean daily motion in R. A. 10′ 7″ decreasing, in Dec. 9′ 26″, increasing.

Amphitrite (29), (Compt. Rend., xxxviii, 429, 645).—Mr. Albert Marth, at the Regent's Park Observatory in London, discovered another planet near *Spica Virginis*, on the morning of the second of March. It appears as a star of the tenth magnitude. Mr. Bishop has proposed for it the name *Amphitrite*. The following elements of its orbit were calculated by M. Yvon Villarceau, according to the method given in the *Connaissance des Temps* for 1852, from 16 observations made at Paris during the month of March.

Epoch 1854, March 0·00, M. T. Paris.

Mean anomaly, - -	114° 36′ 54″·58	
Long. perihelion, - -	64 50 22 ·81	Mn. Eqnx.
" asc. node, - -	356 20 34 ·94	Mar. 0·0, 1854.
Inclination, - - -	- 6 6 19 ·69	
Angle of eccentricity, -	- 4 34 47 ·04	
Mean daily motion, -	- 864″·3666	
Semi-axis major, - -	- 2·5637300	
Period of revolution, -	- 4yrs. 104962	

This planet was discovered independently by M. Chacornac, assistant observer at the Observatory of Paris on the third of March. He also on the fourth of February, at Marseilles, noted a star of the tenth magnitude which is now wanting in that place, and which is shown to have been the body first recognised as a planet by Mr. Marth.

New Comet I. of 1854, (Comptes Pend., xxxviii, 648).—The comet which was visible to the naked eye on the twenty-ninth of March last and the few following days, was seen on the same day in Paris The following elements were computed by Mr. James Ferguson (Astron. Journ., No. 71), from the Washington observations of April 3, 7 and 11.

Perihelion passage, 1854, March 24·0581, M. T. Berlin.

Long. perihelion, - - -	214° 52′ 52″·0	Mn. Eqnx.
" asc. node, - -	316 19 58 ·2	Apr. 7·0, 1854.
Inclination, - - -	83 30 33 ·4	
Log. perihelion dist., -	9·441070	
Motion, - - -	Retrograde.	

This comet was seen in the east on the morning of the twenty-third of March by Mr. Alfred de Menciaux near Damazan in France.—*Cor. Sill. Jour.*

Proportion and Properties of Metallic Aluminum.—St. Clair Deville has communicated a memoir on aluminum which contains some new facts but which does not add enough to our positive knowledge to justify the extraordinary flourish of trumpets with which the communication was made and received. The metal was prepared by Wöhler's method, namely, by heating the chlorid with sodium, and afterwards fusing the globules into one mass under the mixture of common salt and chlorid of aluminum. As thus prepared it was silver white, malleable and ductile, and had the fusing point of silver. Its hardness was increased by hammering but it again became soft on heating. Its density was 2·56; it was a good conductor of heat and could be fused and poured out in the air without becoming sensibly oxydized. Aluminum is completely malleable in dry air or moist. Sulphureted hydrogen, hot and cold water, nitric acid weak or concentrated, and dilute sulphuric acid have no action upon it. Its true solvent is muriatic acid with which evolves hydrogen, sesquichlorid of aluminum being formed. Heated to redness in muriatic acid gas it yields dry and volatile sesquichlorid. The author stated that the chlorid of aluminum was acted upon by common metals at high temperatures and hoped that further experiments would point out a simple and a cheap method of procuring in large quantities and at a low rate a metal so likely to be useful in the arts. The Academy unanimously voted that a sum of money should be placed at the disposal of M. Deville to aid him in the prosecution of his experiments.—*Comptes Rendus, Feb. 6th*, 1854.

Detection of Manganese.—Solids to be examined for manganese are finely powdered; fluids require no preparation. The smallest portion of either is mixed with a drop of a solution of pure caustic potash, and heated over a gas-flame. On boiling the alkali to dryness and raising the heat, the characteristic green colour of manganate of potash will appear. The best support is a slip of silver-foil, two or three inches long, and a-half-an-inch wide. In this manner manganese has been detected in a single drop of a solution, containing one grain of solid sulphate in ten thousand of water. The presence of other oxides does not interfere.—*Artizan.*

Zinc applied to Ship-Building.—A sloop built of zinc, with iron framing and wooden decks, called the "Comte Ldhon," has been constructed at Nantes, France, by Mr. Gulbert, and named after one of the directors of the Vieille Montagne Company. She is elegant in form, draws but little water, and is considered in every respect a first-rate vessel. The command was given to Captain Jouanna, of Lorient, and her first voyage was to Rio Janeiro, from which place she has returned. The captain reports that the experiment has been highly satisfactory: she has proved an excellent sea-boat in repeated gales, which she had to encounter; and one fact is stated of much importance—that her compasses had never been in the slightest degree affected, a circumstance which often happens on iron ships, by which serious casualties have occurred.

Glaciers.—In a letter to Arago, M. De la Rive attributes the sudden appearance of vast glaciers in divers parts of Europe to a temporary refrigeration produced at the period of the elevation of the most recent European strata, by the evaporation of the water with which they were previovsly covered. If evaporation takes place more rapidly from water mixed with sand, earth, or any similar substance than from a surface of clear water, it becomes natural to conclude, that the cold produced by evaporation from the recently-elevated and still humid strata, must have been greater than that resulting from the evaporation of the sea or fresh-water lake which covered them previously to a great depth.—*Bibliotheque Universelle, April*, 1853.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—May, 1854.

Latitude, 43 *deg.* 39.4 *min. North.* *Longitude*, 79 *deg.* 21. *min. West.* *Elevation above Lake Ontario*, 108 *feet.*

Magnet.	Day.	Barom. at temp. of 32 deg.				Temp. of the Air.				Tension of Vapour.				Humidity of Air.				Wind.				Rain in Inch.	Snow in Inch.
		6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Mean Vel'y		
						°	°	°	°														
a	1	29·515	29·460	29·488	29·487	40·2	55·3	45·2	46·75	0·222	0·265	0·235	0·246	·90	·62	·80	·78	W N W	S	S E b.S	8·79	...	...
a	2	·441	·355	·428	·405	47·4	53·5	42·8	47·52	·276	·368	·255	·289	85	91	98	88	Calm	E S E	S	3·02	0.265	...
a	3	·399	·503	·594	·506	43·8	52·1	48·4	46·62	·267	·295	·230	·265	94	77	83	85	N W	N b E	N W	7·32	0·025	...
b	4	·600	·559	·444	·519	48.4	58·6	46·0	51·53	·230	·266	·261	·261	83	55	85	71	N b E	S b W	S b W	8·15	...	...
a	5	·376	·484	·554	·476	45·2	53·8	39·5	46·78	·252	·226	·188	·231	85	55	78	74	E b S	NWbW	NWbW	10·59	...	...
a	6	·625	·611	·670	·638	33·9	38·9	28·4	33·63	·127	·101	·114	·119	65	43	73	63	N N W	N N E	NWbN	11·67	...	...
a	7	·654	·590	—	—	31·6	49·9	—	—	·118	·199	—	—	66	56	—	—	N N W	N N W	—	9·81	...	...
b	8	·648	·612	·575	·601	34·5	56·6	49·9	47·80	·143	·168	·227	·196	72	37	92	68	NWbN	S S W	Calm	4·89	...	...
b	9	·481	·360	·351	·393	40·9	54·9	41·3	45·88	·201	·229	·187	·211	79	54	73	69	Calm	E S E	E S E	3·20	...	...
—	10	·295	·259	·368	·306	47·0	53·5	48·5	50·53	·262	·368	·296	·314	82	91	88	85	E	S E b E	N N W	4·19	0·235	...
b	11	·501	·462	·548	·505	42·4	55·2	50·4	50·72	·221	·273	·285	·263	82	64	80	73	N N W	S W b S	W S W	6·72	Inap.	...
b	12	·734	·738	·758	·743	49·4	61·5	54·4	55·07	·213	·311	·251	·264	61	58	61	62	Calm	S E b E	N E b E	5·05	...	...
a	13	·780	·710	·620	·696	57·4	68·6	60·4	62·43	·294	·459	·381	·384	64	67	75	69	E	E	S E b E	8·14	0·040	...
ac	14	·593	·484	—	—	55·3	58·2	—	—	·346	·444	—	—	81	93	—	—	E	Calm	—	3·72	0·455	...
c	15	·576	·517	·564	·557	53·5	57·8	57·7	56·70	·312	·377	·348	·347	78	80	75	76	W	S W b S	S W	6·48	Inap.	...
c	16	·677	·686	·507	·596	48·4	59·4	52·4	54·72	·267	·350	·308	·316	83	70	80	76	N N W	S E b E	E	7·15	...	...
b	17	·298	·080	·201	·183	54·6	66·6	53·0	59·13	·377	·431	·360	·401	90	68	91	82	E b N	E b S	S W b S	6·35	0·915	...
a	18	·276	·316	·442	·353	53·1	63·2	49·6	55·38	·362	·235	·295	·318	91	41	85	76	S E b S	S W b S	S W	8·45	...	...
b	19	·549	·434	·540	·515	50·0	58·5	45·0	50·12	·283	·333	·268	·288	80	69	90	80	S b E	E b S	S S W	5·41	0·505	...
d	20	·547	·534	·598	·567	46·8	54·2	44·6	49·03	·283	·296	·235	·287	91	73	81	83	S b E	W N W	Calm	4·55	0·275	...
c	21	·636	·646	—	—	49·0	51·3	—	—	·286	·329	—	—	83	88	—	—	S S W	S S W	—	4·74	0·315	...
a	22	·822	·878	·918	·876	43·2	55·6	43·4	48·28	·228	·242	·250	·257	83	79	90	81	NWbN	S b W	S	3·78	Inap.	...
a	23	·969	·940	·853	·917	41·4	58·7	44·9	50·38	·217	·307	·231	·260	84	64	78	78	S	S E b S	S E	3·80	...	...
b	24	·799	·656	—	—	49·7	63 0	—	—	·235	·377	—	—	67	67	—	—	E b N	S E b E	—	3·71	0·765	...
c	25	·445	·442	·562	·481	54·7	67·5	59·9	61·15	·372	·469	·475	·459	89	71	94	87	S W b S	S S W	N N W	4·03	0·835	...
b	26	·675	·656	·661	·665	55·5	66·0	54·4	58·63	·385	·463	·343	·392	89	74	82	80	N b E	S W b S	Calm	3·63	...	...
b	27	·716	·700	·650	·687	56·0	68·9	52·4	59·93	·312	·382	·309	·344	71	56	80	69	S	E S E	S E	2·62	...	...
a	28	·624	·626	—	—	54·6	66·7	—	—	·363	·298	—	.	87	46	—	—	N E b N	S E	—	1·44	...	...
a	29	·634	·620	·564	·601	56·3	68·0	55·6	60·88	·384	·343	·315	·331	86	52	72	65	Calm	E S E	E b N	5·36	...	...
b	30	·526	·528	·669	·586	59·7	63·2	53·1	58·55	·280	·331	·179	·254	56	59	45	51	N E	S	N E b E	5·78	...	...
c	31	·830	·858	·886	·858	48·0	55·2	42·4	49·03	·154	·229	·159	·184	46	54	59	54	N E b N	S E b E	S E b S	4·78	...	...
																		Miles.	Miles.	Miles.	Miles		
	M	29·574	29·548	29·577	29·566	47·93	58·67	28·41	52·20	0·266	0·312	0·269	0·288	79	64	79	74	4·54	7·85	8·73	5·38	4·630	0·0

Highest Barometer...... 29·986, at 8 a.m. on 23rd } Monthly range:
Lowest Barometer....... 29·066, at 4 p.m. on 17th } 0·920 inches.

Highest temperature.. 71°·4, at p.m. on 13th } Monthly range:
Lowest temperature... 25°·2, at a.m. on 7th } 46°·2.

Mean Maximum Thermometer............. 61°·82 } Mean daily range:
Mean Minimum Thermometer............. 37°·90 } 23°·92.

Greatest daily range......... 32°·2, from p.m. of 30th to a.m. of 31st.

Warmest day....... 13th. Mean temperature...... 62°·43 } Difference,
Coldest day......... 6th. Mean temperature...... 33°·63 } 28°·80.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1281·43	1114·95	1358·85	1289·14

Mean direction of the Wind, E 24° S.
Mean velocity of the Wind, 5·38 miles per hour.
Maximum velocity, 21·6 miles per hour, from 3 to 4 p.m. on 6th.
Most windy day, the 6th; mean velocity, 11·67 miles per hour.
Least windy day, the 28th; mean velocity, 1·44 " "
Raining on 11 days. Raining 39·7 hours; depth, 4·630 inches.
During the very heavy rain from 4·05 to 4·25 p.m. on the 25th, there fell 0·765 inches on the surface.
Snow, none. Hailstones fell on the 20th and 21st.
Thunderstorms on the 10th, 11th, 17th, 20th, and 25th.
Rainbows observed on the 8th and 11th.
Splendid meteor observed at 9 p.m. on the 12th; course, from S.W. to N.W.; time of flight, about 8s.
Sun eclipsed from 3·45 p.m. to 6·14 p.m. on the 26th.
Aurora observed on 6 nights.
Possible to see Aurora on 17 nights.
Impossible to see Aurora on 8 nights.

13th. Humming-bird seen near the top of the College Avenue.
14th. Wild strawberries in blossom.
17th. Plum-trees generally in full blossom.
20th. Wild cherry-trees in full bloom.
28th. Snake seen in the College Avenue.
30th. Chestnut-trees in the College grounds in blossom.
31st. Lilac-trees in bloom.

Comparative Table for May.

Year.	Temperature.				Rain.		Snow.		Wind.
	Mean.	Max. obs'vd.	Min. obs'vd.	Range.	D's.	Inch.	D'ys	Inch.	Mean Vel'y.
	°	°	°	°					
1840	53·8	74·5	30·8	43·7	9	4·150	0	...	...
1841	50·5	76·2	26·6	49·6	11	2·350	1	Inap.	0·35 lb.
1842	49·1	74·3	30·0	44·3	7	1·275	0	...	0·58 lb.
1843	49·1	79·6	28·9	50·7	5	1·570	0	...	0·52 lb.
1844	53·6	77·7	29·0	48·7	14	5·670	0	...	0·30 lb.
1845	49·6	76·6	29·4	47·2	8	2·300	0	...	0·55 lb.
1846	55·5	78·1	34·3	43·8	9	4·375	0	...	0·46 lb.
1847	54·4	72·5	27·8	44·7	12	2·040	0	...	0·29 lb.
1848	54·1	78·5	31·9	46·6	13	2·520	0	...	4·93 Miles.
1849	48·0	72·5	32·7	39·8	16	5·115	0	...	5·33 Miles.
1850	47·6	76·3	31·1	45·2	7	0·545	1	Inap.	6·32 Miles.
1851	51·3	73·2	28·7	44·5	12	2·950	1	0·5	6·34 Miles.
1852	51·4	73·3	34·5	38·8	7	1·125	1	Inap.	4·00 Miles.
1853	50·9	78·4	38·4	40·0	17	4·420	1	Inap.	5·14 Miles.
1854	52·2	69·0	27·6	41·4	11	4·630	0	0·0	5·38 Miles.
									0·43 lb.
M'n.	51·41	75·38	30·78	44·60	10·5	3·002	0·3	0·03	5·35 Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.——May, 1854.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 *deg.* 32 *min. North. Longitude*—73 *deg.* 36 *min. West. Height above the Level of the Sea*—118 *Feet.*

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	Inch.	6 A.M.	2 P.M.	10 P.M.
1	29·468	29·558	29·617	41.2	53·0	42·0	·253	·310	·248	·91	·73	·85	W b S	W	W S W	2·14	1·11	4·62	0·903	Str. 10.	Cir. Str. 10.	Cum. Str. 9.
2	·690	·558	·551	41·0	59·0	51·0	258	338	315	92	66	81	S W	S W b W	S S W	0·76	4·01	1·83		Hazy.	Cir. Cum. Str. 8.	Cir. Cum. 8.
3	·636	·612	·671	44·2	61·0	49·2	223	304	216	73	56	60	N E	N E	N E	10·91	4·33	14·75		Cir. Str. 4.	Clear.	Clear.
4	·751	·677	·622	46·5	71·0	51·0	210	435	315	64	57	81	N E	S E b E	S S E	13·83	2·19	0·65		Clear.	Do.	Do. Aurora Bo.
5	·521	·381	·505	55·0	66·2	38·6	312	373	173	70	58	70	W S W	W S W	N W	1·60	5·50	16·30		Do.	Cir.Cum. Str.10.	Cir. Str. 6.
6	·603	·566	·581	26·0	29·0	28·0	135	110	126	88	61	73	N b W	N W b W	N W b W	15·55	27·84	25·56		Str. 4.	Cum. Str. 4.	Cum. Str. 10.
7	·582	·485	·552	26·2	43·2	37·7	129	233	199	80	79	81	W N W	W N W	N W	29·05	21·08	16·66		Do. 10.	Cir. 2.	Cir. Str. 3.
8	·709	·575	·631	36·0	57·9	48·0	192	327	242	83	66	69	W b N	N W b W	N W	2·12	8·16	9·76		Do. 9.	Clear.	Clear.
9	·673	·614	·549	35·7	69·0	59·5	203	461	460	91	65	90	S W	S b W	S b W	Calm	Calm	Calm		Clear.	Do.	Str. 10.
10	·545	·500	·440	57·6	73·1	59·0	376	530	488	79	66	96	N N E	S E b E	S S E	0·37	0·10	0·15	0·007	Do.	Str. 10.	Cum. Str. 9.*
11	·596	·635	·694	57·0	70·1	56·5	376	568	287	79	78	62	W b S	W S W	S S W	3·41	8·73	9·81		Do.	Clear.	Cir. Cum. 9.
12	·880	·881	·935	58·5	73·8	58·6	274	380	308	55	47	63	W	W S W	W	5·31	3·12	3·87		Do.	Do.	Clear.
13	30·080	30·076	30·011	47·0	77·0	61·1	·262	435	332	77	47	61	N E b E	N E b E	N E b E	Calm	2·71	1·15		Do.	Do.	Do.
14	30·024	29·856	29·704	63·0	75·2	64·0	411	530	520	71	62	85	S b E	S S E	S b E	4·11	13·88	18·30		Do. [do.	Str. 8.	Str. 10.
15	29·647	·711	·816	68·8	77·7	64·2	449	414	379	72	45	63	W b N	W S W	W S W	2·50	0·68	Calm	Inap.	Shower in night	Do. 2.	Do. 4.
16	·824	·801	·82	61·9	74·0	60·7	397	458	361	71	55	68	W S W	W S W	E N E	Calm	10·31	Calm		Do.	Clear.	Clear Aur. Bo.
17	·809	·635	·580	55·6	84·0	69·4	343	660	486	74	57	69	N E	S b E	S b E	0·22	9·25	19·12		Cir. Cum. Str. 4.	Do.	Str. 4.
18	·583	·572	·527	62·9	62·5	59·2	516	499	478	90	89	94	W b S	S b E	S S E	18·50	2·94	Calm	1·033	Str. 10. Rain at 3	Showers.	Do. 9.
19	·741	·677	·679	58·1	75·9	60·1	389	407	441	79	47	84	W S W	S b W	W S W	Calm	0·88	0·44		Cum.Str.4.[a.m.	Clear.	Do. 2.
20	·780	·758	·785	53·9	74·1	58·0	337	435	346	81	52	70	W S W	S W b S	W b S	7·37	1·47	2·77	Inap.	Do. 4.	Cir. Str. 4.	Cum. Str. 4.
21	·853	·842	·795	57·6	60·9	52·2	316	330	349	66	63	87	W N W	N W b N	N W b N	3·62	2·17	Calm	0·366	Clear.	Do. 8.	Rain at 8·10
22	·900	·939	30·012	53·0	55·7	47·9	361	331	302	87	74	86	W	W b N	W b N	0·18	1·80	4·15	0·530	Rain in the night	Showers.	Clear. [p.m.
23	30·089	30·072	30·018	51·4	62·3	51·4	293	297	293	76	53	76	N W b W	Calm	S S W	Calm	Calm	0·08		Clear.	Cir. Cum. 2.	Do. Aurora Bo.
24	·040	29·850	29·758	58·5	76·1	61·1	367	368	362	75	64	66	Calm	S W	S b E	Calm	Calm	0·53		Do.	Clear.	Do.
25	29·672	·523	·542	60·0	59·9	57·0	441	467	464	84	90	98	S	S b E	N W b W	2·51	4·59	3·77	0·559	Cum.Str.9. Rain	Cum. Str. 10.	Str. 2.
26	·639	·671	·804	55·0	73·0	56·2	341	534	408	76	65	89	N	N E b E	E N E	9·37	10·00	8·19		Clear. [at 10·45.	Str. 8.	Clear. Aur. Bo.
27	·946	·804	·663	57·3	77·0	60·0	376	594	467	79	66	89	N E b E	E N E	S S W	5·38	3·03	3·76		Do.	Clear.	Do.
28	·777	·758	·784	63·1	75·1	57·2	516	607	376	89	71	79	S W	E b N	E N E	0·10	3·93	0·52		Do.	Cum. Str. 4.	Do. Aurora Bo.
29	·887	·718	·686	50·1	75·8	53·2	304	528	293	81	61	70	E N E	W b S	N b W	7·40	1·25	1·62		Do.	Clear.	Do.
30	·730	·700	·921	53·1	66·8	40·4	207	317	179	49	49	67	E b N	E	N E	0·62	5·64	8·95		Do.	Cum. 4.	Do.
31	30·045	·912	·942	50·0	68·6	51·0	199	339	263	53	49	69	E b N	S W b W	S E	1·00	2·14	3·62		Do.	Do. 2.	Do.

Barometer	Highest, the 23rd day	30·089
	Lowest, the 5th day	29·881
	Monthly Mean	29·731
	" Range	0·708
Thermometer.	Highest, the 17th day	84°·9
	Lowest, the 6th day	24°·2
	Monthly Mean	57°·17
	" Range	60°·7
	Mean Humidity	·723
Greatest Intensity of the Sun's Rays		128°·0

Amount of evaporation, 4·13 inches.
Rain fell on 8 days. Raining 32 hours; amounting to 3·418 inches.
Most prevalent Wind, W S W. Least prevalent Wind, S.
Most Windy Day, the 6th day; mean miles per hour, 23·98.
Least Windy Day, the 23rd day; mean miles per hour, 0·03.
Frogs first heard 2nd May.
Aurora Borealis visible on 5 nights. Might have been seen on 15 nights.
Annular eclipse of the sun on the 26th day, at 4h. 11m. 3s.
The electrical state of the atmosphere has been marked by feeble intensity, except on the 10th, 20th, and 22nd day, when it indicated a high tension of a positive charactor.

* Showers at 3·40 p.m.

Monthly Meteorological Register, Quebec, Canada East.—April, 1854.

BY LIEUT. A. NOBLE, R.A.

Latitude, 46 *deg.* 49·2 *min. North; Longitude,* 71 *deg.* 16 *min. West. Elevation above the level of the Sea, — Feet.*

Date.	Barometer corrected and reduced to 32 degrees, Fahr.				Temperature of Air.				Elasticity of Air.				Humidity of Air.				Direction of Wind.			Velocity of Miles.			Rain in inch.	Snow in inch.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.		
					°	°	°	°																
1	29·476	29·215	29·341	29·344	32·0	39·2	35·0	35·40	·181	·226	·168	·192	00	95	83	93	E S E	Calm	E S E	3·8	...	10·1	0·25	...
2	29·637	29·877	30·120	29·878	23·3	31·3	17·2	23·93	113	139	087	113	87	79	87	84	E S E	W N W	W N W	5·2	8·8	7·2	...	...
3	30·316	30·176	30·192	30·228	8·3	35·8	23·2	22·43	054	134	109	099	79	65	85	76	W N W	W N W	W N W	6·2	7·2	8·0	...	...
4	30·106	30·042	30·080	30·076	26·0	44·2	36·2	35·47	180	172	155	152	91	60	73	75	Calm	W	W	...	8·0	7·2	...	...
5	30·039	29·846	29·662	29·849	34·3	47·6	41·5	41·13	158	178	193	176	79	54	75	69	Calm	Calm	W	...	...	3·8	...	...
6	29·547	29·370	29·276	29·398	41·2	52·2	43·3	45·57	236	281	253	257	92	73	91	89	Calm	W S W	W S W	...	3·8	3·8	0·24	0·2
7	29·683	29·846	30·060	29·863	32·2	37·3	25·3	31·93	164	129	135	143	91	58	96	82	N N W	W N W	N	10·1	8·0	7·2	...	...
8	30·111	30·032	29·920	30·021	23·0	36·0	28·3	29·10	108	175	136	140	86	82	97	88	E N E	E N E	E	8·0	8·8	3·8	...	0·3
9	29·856	29·800	·700	29·785	30·0	36·2	32·3	32·87	134	208	160	167	80	89	88	86	E	E	E	8·0	8·8	13·9	...	0·3
10	·507	·491	·568	·522	31·0	39·8	31·2	37·00	165	186	155	169	95	77	89	87	E	E	E	11·3	10·1	5·2	...	...
11	·717	·776	·775	·756	30·8	36·0	27·0	31·27	159	192	123	158	93	91	82	89	N	E	Calm	8·8	8·0	...	...	...
12	·788	·720	·865	·791	23·3	50·0	38·3	37·20	112	194	228	178	86	55	94	78	W	W	Calm	8·8	9·6	...	...	...
13	30·070	30·143	30·257	80·157	25·0	27·5	...	...	122	131	...	...	88	86	...	...	E	E	N N W	10·1	11·3	12·4	...	...
14	30·292	30·175	30·131	30·199	11·0	33·8	29·5	24·77	063	169	139	124	82	88	84	85	N N W	W S W	W S W	11·3	10·1	6·2	...	...
15	30·055	29·930	29·888	29·958	21·8	32·0	26·0	29·93	094	127	132	118	78	70	92	80	Calm	E	E	...	5·2	5·2	...	...
16	29·956	·989	·980	·975	15·8	81·8	24·5	27·37	082	158	111	117	87	88	82	86	E	E	E	3·8	5·2	3·8	...	...
17	·992	·873	·749	·872	15·6	33·5	29·5	26·20	075	145	131	117	81	78	80	80	Calm	E	E	...	20·2	11·3	...	...
18	·711	·589	·609	·634	30·3	36·5	30·0	32·27	132	188	134	151	78	87	80	82	E S E	E S E	E S E	11·3	8·0	6·2	...	...
19	·582	·507	·429	·506	29·8	50·8	41·0	40·53	130	183	172	162	78	50	67	65	W	W	S	6·2	7·2	8·0	...	...
20	·517	·544	·596	·552	34·2	48·6	38·8	40·53	167	175	153	165	85	52	66	68	S	S	S S E	7·2	4·2	5·2	...	...
21	·720	·727	·749	·732	33·0	42·0	31·3	35·43	150	142	141	144	79	54	81	71	N W	E N E	E N E	6·2	5·2	5·2	...	...
22	·762	·649	·593	·668	29·8	44·0	34·0	35·93	134	159	161	151	80	56	81	72	E N E	E N E	E N E	6·2	6·2	6·2	...	...
23	·668	·744	·794	·735	38·0	40·0	34·0	37·33	138	129	094	120	61	53	48	54	E N E	Calm	Calm	13·9	...	...	...	...
24	·835	·711	·584	·710	28·5	50·5	41·0	40·00	120	153	163	145	75	43	64	61	W S W	W S W	W S W	5·2	5·2	6·2	...	...
25	·548	·546	·554	·549	34·0	54·7	43·0	43·90	...	...	...	...	...	...	...	...	W S W	W S W	Calm	8·0	6·2	...	...	...
26	·546	·416	·803	·422	33·8	46·0	39·0	39·60	140	261	195	199	72	83	83	83	S	Calm	Calm	3·8	...	...	0·4	...
27	·450	·685	·803	·646	37·3	37·0	35·0	36·43	158	176	151	162	72	80	74	79	N	N	Calm	3·8	8 0	...	...	1·5
28	·996	30·166	30·205	30·102	32·8	38·8	34·0	35·20	169	178	161	169	91	79	81	84	E	E	Calm	10·1	13·4	...	...	1.0
29	30·240	30·246	30·081	30·189	33·8	39 6	36·0	36·13	164	156	175	158	85	65	82	77	E	E	E	11·3	16·0	21·2	1·1	...
30	30·000	29·930	29·812	29·914	36·8	38·5	37·0	37·27	169	220	191	193	79	95	87	87	E	E	E	22·1	19·7	21·2	0·9	...
M	29·8243	29·7887	29·7792	29·7974	28·73	40·82	33·19	34·23	139	176	155	156	86	76	81	81				7·02	7·48	6·28	3·89	3·3

REMARKS.

2nd. Aurora visible, faint arch and dark segment underneath, at 10h. 15m. Bright streamers shot out suddenly.

10th. At 2 p.m. the clouds were arranged in and parallel to the magnetic meridian. The early part of the night hazy, and a very fine lunar halo, 40° in diameter, visible from 8 to 12. A magnificent Aurora observed: great magnetic disturbance.

17th. At 2 p.m. a remarkable bunch of cirrous clouds at right angles to magnetic meridian, right across the sky.

23rd. Aurora visible immediately after sunset, and as soon as stars of the first magnitude.

24th. The ice opposite Quebec gave way, but that at Cape Rouge still firm.

25th. Swallows seen.

26th. Wheel carriages employed in the town.

Maximum Barometer, at 6 a.m. on the 3rd.............. 30·316 } Monthly Range, 1·101 in.
Minimum Barometer, at 2 p.m. on the 1st............... 29·215 }

Maximum Thermometer, on the 25th........................ 55°·0 } Monthly Range, 49°·0
Minimum Thermometer, on the 2nd.......................... 6°·0 }

Mean Maximum Thermometer.............................. 41°·0 } Mean Daily Range, 17°·7
Mean Minimum Thermometer............................... 23°·8 }

Greatest Daily Range, on the 12th....... .... 31°·0
Least Daily Range, on the 14th.. .... 2°·8

Warmest Day, the 6th; mean temperature............ 45°·57 } Climatic Difference, 23°·14
Coldest Day, the 3rd; mean temperature............... 22°·43 }

Possible to see Aurora on 17 nights.
Aurora visible on 16 nights.